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The President's Messages

THE recent messages of the President to the Congress, now in session, so far as they deal with the shipping problem contain little of encouragement either for the shipowner or for the shipbuilder.

So far as can be judged by his few and meager references to it, the President looks upon shipping as an unwelcome responsibility which, against his will, he is obliged to accept. No one can find serious fault with his general policy of economy; its value is sufficiently reflected by the almost universal prosperity of the country but economy, like many other good things, may be carried too far. When the enforcement of a policy commences to work positive hardship, when it threatens to destroy rather than build up business, it is time to call a halt—to find just where the path is leading.

Fortunately for them, the shipyards are not altogether dependent upon the present action of the government. Our merchant marine in active employment is vastly larger and more important than it was before the war, mainly because of the opening of the Panama Canal, and this implies a steady even if relatively small demand for new vessels. On the other hand, the large shipyards which form the backbone of the industry grew to their present size and importance mainly as the result of naval shipbuilding. For the present, at least, this latter support is much reduced and the yards must look elsewhere for the work needed to hold together their very special and highly trained organizations—organizations, by the way, which if once dispensed with can be replaced only after years of study and practical experience have been spent in training the new men for their work.

There are two sources which may readily be opened to supply additional work to the shipyards. In both cases the need of new vessels is immediate and pressing, but this the President apparently fails entirely to grasp. On the one hand he says, as concerns merchant vessels, that we need no more ships, but more freight; evidently unmindful of the fact that in the very near future such freight as we now carry is likely to be taken away from us by foreign vessels, newer, faster and more economical than our own. Speaking of the Navy, he calls it the best in the world, the equal of any. Just what this means is difficult to determine. Our vessels, individually, are no doubt the equal of those of their respective classes to be found elsewhere but taking the fleet as a whole we are entirely outclassed and of this the President must be as well aware as anyone else. Talk of really effective disarmament is at this time but a gesture. Europe has no thought of actually disarming although it would doubtless applaud such action on our part. In this direction we have done enough, more than enough, and it is time that this country ceased acting the part of the goat in international affairs. With the elimination of capital ships, the next line of defense is the cruisers, and here we are far from holding our own. We have two building and five more authorized, but for the sake of being consistent in our efforts toward world disarmament the President says we must build no more. Were these efforts towards disarmament likely to produce material results, were they in reality anything more than the public expression of a wish on the part of many of our righteous but misguided and misinformed citizens, then by all means have *no* navy, leave the door open and unprotected that all may enter, when and as they will. No sane man can believe that such a condition will come in the near future, if indeed it ever does. The world is *not* going to disarm and we, its richest and most envied nation, have need, above all others, to watch our step and guard our doors.

The Congress apparently has made a more correct appraisal of the actual naval situation than has the Chief Executive. It has definitely expressed its intention to uphold the implied obligations of the Naval Disarmament Treaty, not on paper alone, but in fact. Paper ships will *not* do at this juncture whatever their value for political maneuvering may be. The Congress recognizes the need of new vessels and evidently intends to see to it that they are built. More power to it!

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Tanker Explosions

RECENT too-numerous explosions on oil tank vessels have drawn renewed attention to the very special problems involved in the design and construction of these vessels and the particular precautions which are essential to their safe operation. Tankers are of peculiar interest to Americans as they comprise a very large proportion of our commercial vessels and an aggregate tonnage greater than the tanker fleet of any other nation.

The fact that out of such a very large fleet of ships relatively very few get into serious trouble seems to prove pretty conclusively that a tank vessel of ordinarily good construction and reasonably well operated is little if any more liable to serious accidents than a general cargo vessel, but the recent serious explosions demonstrate the peculiar dangers that, in more or less degree, are always present and the main protection against which is constant vigilance and care.

With a cargo of naptha, gasoline or other very volatile and inflammable liquid special precautions are always taken otherwise few such cargoes would ever be delivered. A full cargo of heavy oil or kerosene, on the other hand, is not particularly dangerous and it is this fact, probably, which is one of the principal causes of explosions. So long as the cargo tanks are filled with oil there is little danger, in a well built ship, from the cargo itself. If, by any chance, the surface of the oil takes fire, it can only burn as fast as air is supplied to it, and by the fire extinguishing apparatus which is now available this supply can be effectively cut off by a blanket of bubbles, filled with some inert gas. Once the tanks are pumped out, however, the situation radically changes and the possibility of dangerous explosion is greatly increased. Some oil is bound to remain in the bottom of the tank and this together with the oil film left on the sides and bulkheads gives off vapor which when mixed with the right proportion of air is highly explosive. With the shifting and replacement of crews which is bound to take place some inexperienced men must find their way on board and with these the confidence and carelessness bred on a first trip on a loaded tanker may easily lead to trouble when the load has been discharged and constant danger takes the place of relative security.

The safety of a tanker must commence to be insured from the laying of her keel. The design must be such that the working of calked joints is practically eliminated and only the best and most perfect of riveting can be allowed. From the standpoint of construction, probably the Isherwood system of longitudinal framing has in the past done more than any other one thing to contribute to the construction of safe tank vessels, and now the same designer has developed the "bracketless" system, which, by doing away with numberless bracket connections and their accompanying rivets, takes a long step forward in the same direction.

While defective workmanship or design may easily spell disaster the main cause of trouble is undoubtedly defective or careless operation rather than defective building. On the active tanker eternal vigilance is truly the price of safety and there can be no let-down of the strict rules covering the action and personal habits of crews if danger is to be avoided.

The National Fire Protection Association has already done much good work in the drawing up of rules and regulations covering tanker operation. Although these rules are not mandatory, they are closely followed by the large oil companies and, now that recurring explosions have indicated the desirability of further steps in the same direction, it has been suggested that a technical committee be formed by these companies to study the causes of tanker explosions and provide means for their prevention.

The matter is evidently a serious one, it will evidently have to be handled by experts, drawn mainly from the tanker operators themselves. It is surely to be hoped that such a committee may immediately get into action and take such steps as may be necessary to reduce the probability of accident to the smallest possible fraction. Undoubtedly a "fool proof" tanker can never be designed, indeed it is not entirely desirable that it should be—fools have no place on oil tank vessels. In the meantime it seems apparent that much may be done to more fully guarantee the safety of existing vessels and those to be built in the future.

A Problem of Coastal Navigation

THERE recently appeared in the Liverpool *Journal of Commerce* an exceedingly able and interesting article by Mr. A. C. Hardy,* on cross channel steamers, comparing these vessels with those built in this country for somewhat similar service. The features peculiar to the American type of vessel are of course well known in this country, but it must be remembered that the article is written for British readers.

As the author points out, the main differences between the English Channel vessels and their American prototypes are to be found in the arrangement of the passenger quarters and the handling of freight.

The channel steamers are in effect small steamships, the arrangement of large, seagoing vessels being in general followed. Thus the passenger accommodations are nearly all, if not entirely, located below in the hull proper, while the relatively small beam results in restricted and often badly obstructed deck areas. Cargo is all carried in the holds, being handled by winches and necessitating the fitting of hatch trunks which occupy valuable space that otherwise would be available for passengers. The carrying of freight in the 'tween decks, handling it through side ports by means of trucks is practically unknown.

In the American bay or sound steamer, on the other hand, the passenger accommodation is all, or nearly all, on the upper deck of the hull proper and above it on the so-called saloon and gallery decks. The hull, above the waterline, is flared out or guards are built on with the result that the passenger decks are considerably wider than the hull itself and correspondingly roomy. Practically all cargo is carried in the main 'tween decks, between the upper deck of the

* Editor of MOTORSHIP.

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hull and the saloon deck. As this cargo is usually bulky, rather than heavy, full advantage can be taken of the greatly increased stowage space resulting from the guards or flared topsides. Elevators are provided for handling cargo in the holds, but the hatches are all "blind," no trunks being fitted up through the passenger quarters. All cargo is loaded and discharged through side ports by means of trucks. In many instances freight is loaded on four-wheeled trucks which are drawn on board by electric tractors, the trucks remaining on board with their loads in place to be discharged in similar manner at the end of the trip. While these trucks doubtless occupy considerable space, their use ensures economical and quick handling of freight, a feature which in most cases is a controlling factor in the business in which the ships are engaged.

Of course a comparison of the two classes of vessels cannot be fairly made without taking into account the difference in the services which they respectively have to perform. While certain of the American steamers encounter bad weather and rough seas, particularly in winter, they do not, by any means, have to combat the continuous heavy seas and practically deep sea conditions which the channel vessels have to withstand a very large proportion of the time. It can easily be imagined that a ship fitted with overhanging guards would be very uncomfortable, if not positively dangerous, under the conditions of wind and sea which are often experienced in the English Channel.

Certain seasonal trends of travel in this country have raised the question as to whether a successful combination of the two types of ship cannot be devised. In summer the bulk of the ship-passenger traffic on our Atlantic coast is found on its north-eastern section—from Boston and New York to New England ports and to the Maritime Provinces of Canada. In winter, the reverse is the case. Aside from that carried by the Long Island Sound lines, and this is much reduced, the bulk of the traffic is from New York, Philadelphia and Baltimore to southern and West Indian ports and between the latter. It is, perhaps, impossible to design a vessel which will give a maximum of service on both eastern and southern routes but it is at least not unreasonable to conceive a ship which by its ability to render satisfactory, if not maximum, service all through the year (east and south) would prove a more remunerative investment for its owners than one which, although earning at a high rate for perhaps 5 months, spends the balance of the year in lay-up.

Broadly speaking the production of such a vessel resolves itself into the problem of determining the maximum effective beam which can safely be given to a seagoing ship. In our sound and bay steamers this effective beam, effective as determining passenger and freight space, is the waterline breadth of the hull proper increased by guards, sponsons or flared topsides.

Turning first to the question of waterline beam: there seems to be no very well founded reason for not increasing this to a much greater fraction of the length than is now the rule in the ordinary seagoing or coastwise ship. So far as speed is concerned it has been abundantly proved that great beam is not necessarily prejudicial to speed. A recent example of this is to be found in the latest Canadian-Pacific steamers, operating on Puget Sound. These ships, the *Princess Kathleen* and *Princess Marguerite,* have a molded beam of 60 feet on a length between perpendiculars of 350 feet, a ratio of 5.83 to 1, but nevertheless maintain a speed of 22½ knots without an undue expenditure of power. There are other similar examples, too numerous to mention.

The question of stability may not be so easily disposed of. It is not a matter of too little but rather of too great stability which has to be dealt with; quite the reverse of the situation as regards the usual type of seagoing passenger steamer. While recent years have witnessed a material increase in the beam of these latter vessels without any apparent detrimental effect upon their passenger-carrying qualities, it is obvious that extreme beam in a ship of moderate size, coupled with the same general arrangement of passenger quarters and cargo spaces as obtains in ordinary seagoing ships would result in a most uncomfortable ship, if nothing worse. In other words, the high metacenter resulting from increased beam must be accompanied by a correspondingly high center of gravity of ship and cargo, if comfort and safety in a seaway are to be assured. The disposition of passenger quarters and cargo spaces of the sound or bay steamer lends itself admirably to this requirement. The arrangement of passenger quarters, in large part on upper decks and in superstructures, and the carrying of a very large proportion of the cargo in a 'tween decks space above the hull proper both tend to a very material raising of the center of gravity and the prevention of an excessive metacentric height with consequent quick and heavy rolling. It would, of course, be necessary to make special ballasting arrangements to preserve this condition when carrying a reduced amount of cargo. There does not, however, appear to be any very great difficulty in the way of such arrangements and, furthermore, the provision of side ballast tanks would greatly lessen the danger from collision as well as raise the center of gravity.

The fitting of guards or even of heavily flared concave top sides, the well known "wine glass" section of the bay steamer, is out of the question for a seagoing vessel, but a considerable flare in place of the ordinary tumble home does not appear unreasonable although of course tending to quicken the period of rolling. Its effect would be met in the same manner as that due to increasing the waterline beam while a material addition to effective passenger and cargo spaces would result. It must also be remembered that the carrying of cargo widely spread in a transverse direction, as opposed to its concentration nearer the middle fore and aft line of the ship, tends to increase the latter's moment of inertia and thus lengthen her rolling period.

There are many other problems entering into the design of such a vessel—a hybrid in every sense of the word. That there is a place for such ships on our Atlantic coast, any one who has given thought to the subject can have little doubt. From the viewpoint of both the traffic manager and the naval architect the problem is an interesting one and likely to lead to material developments, particularly in view of the rapid expansion of the coastwise trade, both east and south, in the past two or three years.

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The United States Lines

THE Senate's request that the Shipping Board submit to it, before taking action, the proposals which the board now has in its possession for the disposal by sale and lease of the American Merchant and United States Lines should bring renewed courage to the shipping and shipbuilding industries.

These proposals were evidently made in good faith, the amount of money involved is alone an ample guarantee of the financial responsibility of the parties which have made them while the technical and business ability of these parties is unquestioned as their records are well known and unassailable.

For reasons best known to itself, the board has hesitated in making a decision; so far as can be judged at this writing it is likely to reject the offers which have been made. The proposals are of mainifest advantage to the government if it is at all sincere in its oft expressed desire to dispose of its lines and vessels. Outside of directly interested government shipping circles no adverse criticism of them has been heard. The Shipping Board, at least, is fully aware of the immediate necessity of starting the construction of new vessels if the services under consideration are to continue. It is certain that unless new tonnage to correct present deficiencies and to provide for the requirements of the very near future is not authorized, the lines, in a very few years, will pass out of existence as competitive mercantile organizations.

In view of the seriousness of the situation in which these passenger lines now find themselves and also of the fact that the President's recent messages to the Congress make the possibility of any appropriation for shipbuilding purposes by that body a very remote one, the board's evident reluctance to part with its vessels raises a serious question as to its actual activities and its good faith. One is forced to the conclusion that the board is far more concerned with the retention of these important lines under its own management and the many positions and personal advantages which go with this management than it is with the fostering of private ownership of American ships and the building up of American shipyards.

This paper has been averse to the policy of constant criticism and condemnation of the Shipping Board and all connected with it which has, in certain quarters, prevailed. It has felt that the board and its agencies functioned under peculiar difficulties notwithstanding which it had accomplished much that was good, much that was constructive. These accomplishments have, however, been matters of detail, not of principle. The time has now come when a major decision must be made—a decision which will bring out into the full light of "merciless publicity" the true inwardness of the board's deliberations—what it thinks, what it really wants. Faced by the necessity of publicly demonstrating its singleness of purpose and devotion, in the broadest sense, to the national welfare or on the other hand, of justifying the accusations of its enemies that its policies are fixed mainly by political and personal considerations, the board hesitates. At this juncture, the Senate has stepped in and wants to know the facts. The Shipping Board may perhaps be thankful that it is thus, in a degree, relieved from the responsibility of making a decision. The public, particularly the shipping public, may well be thankful that the whole matter is to be brought out into the open and discussed upon its merits. Once the present proposals are brought before the Commerce Committee of the Senate and their evident advantages and the good faith and public spirit in which they are presented made clear to the members of that body it is unthinkable that the result should be other than a very material increase in the fleet of privately owned and operated ships and a speedy resumption of large and important work by American shipyards.

Trial Trips

IT is a peculiar and unfortunate fact that notwithstanding the enormous amount of experimental work which has been carried out, particularly during the past few years, with reference to the resistance and powering of ships the means of applying the results obtained to the design of the full sized vessel, particularly to slow speed merchant vessels, remain singularly restricted.

The principal deficiency is the lack of definite knowledge of actual ship performance, the very few scientifically conducted and recorded trial trips which are run and, by no means least, the very great difficulty of accurately and intelligently determining the results of these trials—of separating the apparent from the actual.

In an exhaustive contribution to the Proceedings of the North East Coast Institution of Engineers and Shipbuilders, Dr. E. V. Telfer has presented the subject of the interpretation of ship trial data in a rather novel form and has, we believe, opened up the way not only to a better understanding of a difficult subject but to the attainment of much more complete and accurate information regarding the actual sea performance of commercial vessels than is at present generally available.

The extent of Dr. Telfer's paper is far too great to allow of complete comment in a short editorial notice—this we shall hope to give in a later issue. For the present, only one of the subjects treated will be specifically mentioned—the effect of tidal flow upon observed speed. That this flow is always variable is not we believe generally recognized in its full significance. Measured mile speed is often determined by two runs only, one with and one against the current, the mean of the two being taken as the actual speed through the water. If the tidal current preserved a constant velocity, this result might be sufficiently accurate. What may actually take place is illustrated by the following extract from the paper: "Let the vessel's true speed through the water be 10 knots. Take the first run with the current at 0.50 knot and hence the apparent speed on the mile 10.50 knots. The second run (20 minutes later) is against a current now of 0.90 knot, the apparent speed thus being 9.1 knots. The mean of the two is 9.8 knots while the true speed is 10 knots. Conversely had the runs been in the opposite direction at the time of day considered, the two apparent speeds would have been 9.5 and 10.9 knots.

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Output of American Shipyards Increasing

Merchant vessel tonnage built in 1926 nineteen percent greater than in 1925—Sixty-three percent more tonnage now under construction

SHIPBUILDING in the United States in 1926 shows a substantial gain over the previous year and the work now in hand for future delivery is greater than it has been on the first of the year since 1923, according to statistics compiled by MARINE ENGINEERING AND SHIPPING AGE.

TABLE I.—MERCHANT VESSELS COMPLETED IN 1926

	Number of vessels	Total gross tonnage	Total horse-power
Alabama Dry Dock & Shipbuilding Co.	12*	3,780	....
American Bridge Co.	97*	43,095	....
American Brown Boveri Electric Corp.	23	21,738	8,300
American Shipbuilding Co.	3	16,319	4,450
Bethlehem Shipbuilding Corp.	33	19,371	11,635
Wm. Cramp & Sons Ship & Engine Building Co.	4*	2,000	....
Defoe Boat & Motor Works	21	3,360	6,950
Dravo Contracting Co.	95*	16,706	....
Elizabeth City Iron Works & Supply Co.	1	114	120
Federal Shipbuilding Co.	5	5,400	3,600
Fishing Vessel Owners Marine Ways, Inc.	2	80	120
General Engineering & Dry Dock Co.	1	700	1,200
Great Lakes Engineering Works	2	1,800	....
Great Lakes Towing Co.	2	198	1,500
Harbor Boat Building Co.	7	270	785
Howard Shipyards & Dock Co.	9	1,720	2,430
Robert Jacob, Inc.	5	141	669
Jakobson & Peterson, Inc.	5	350	180
Kingston Dry Dock & Construction Co.	11	4,600	1,020
R. Lenahan Co.	14*	9,966	....
Los Angeles Shipbuilding & Dry Dock Co.	3*	829	....
Manitowoc Ship Building Corp.	5	6,987	....
Marietta Manufacturing Co.	17	9,175	1,280
Midland Barge Co.	31*	....	....
Moore Dry Dock Co.	1*	982	....
Wm. Muller Shipyard	3	354	985
Murnan Shipbuilding Corp.	9*	2,500	....
Nashville Bridge Co.	9*	976	440
New London Ship & Engine Co.	6	....	2,425
Newport News Shipbuilding & Dry Dock Co.	18	34,324	22,900
Point Pleasant Dry Dock Co.	1	85	289
Pusey & Jones Co.	2	1,440	2,300
Geo. D. Ryan & Son	1*	400	....
San Diego Marine Construction Co.	6	305	620
Spedden Shipbuilding Co., Inc.	2	397	760
Staten Island Shipbuilding Co.	5	3,489	7,200
Sun Shipbuilding & Dry Dock Co.	9	6,372	2,520
Todd Dry Dock, Engineering & Repair Corp.	3	876	2,440
Chas. Ward Engineering Works	11	4,505	880
	494	225,704	88,008

TABLE II.—MERCHANT VESSELS NOW UNDER CONSTRUCTION

	Number of vessels	Total gross tonnage	Total horse-power
Alabama Dry Dock & Shipbuilding Co.	5*	1,442	....
American Bridge Co.	32*	13,220	....
American Brown Boveri Electric Corp.	36	11,500	8,800
American Shipbuilding Co.	6	51,900	17,100
Bethlehem Shipbuilding Corp.	14	19,690	10,800
Wm. Cramp & Sons Ship & Engine Building Co.	3	26,700	40,000
Defoe Boat & Motor Works	2	320	900
Dravo Contracting Co.	41*	14,940	....
Federal Shipbuilding Co.	2	20,600	11,100
Fishing Vessel Owners Marine Ways, Inc.	3	270	300
General Engineering & Dry Dock Co.	4	3,600	5,400
Great Lakes Engineering Works	1	7,600	2,000
Great Lakes Towing Co.	2	198	1,500
Harbor Boat Building Co.	1	40	70
Howard Shipyards & Dock Co.	10	3,025	180
Robert Jacob, Inc.	2	220	480
Jakobson & Petersen, Inc.	2	280	150
Kingston Dry Dock & Construction Co.	1*	....	....
R. Lenahan Co.	3*	2,210	....
Manitowoc Ship Building Corp.	1	2,950	....
Marietta Manufacturing Co.	44	13,400	1,800
Midland Barge Co.	16*	....	....
Moore Dry Dock Co.	4	9,400	7,000
Wm. Muller Shipyard	1	110	400
Murnan Shipbuilding Corp.	2*	300	....
Nashville Bridge Co.	5*	705	....
New London Ship & Engine Co.	2	....	880
Newport News Shipbuilding & Dry Dock Co.	5	38,200	35,200
Pusey & Jones Co.	1	1,860	2,700
San Diego Marine Construction Co.	2	30	140
Southern Shipyard Corp.	1	320	200
Sun Shipbuilding & Dry Dock Co.	3	11,200	6,000
Todd Dry Dock, Engineering & Repair Corp.	2	....	700
Todd Shipyards Corp.	2	1,040	2,400
Toledo Shipbuilding Co., Inc.	2	11,000	5,000
Chas. Ward Engineering Works	9	3,891	1,440
	272	272,161	162,640

*Barges or non-propelled craft.

American shipyards delivered 494 merchant vessels of 225,704 gross tons in 1926 and now have under construction 272 merchant vessels of 272,161 gross tons. The output in 1926 represents an increase of 19 percent over that in 1925 and 56 percent more than in 1924. The orders now in hand represent 63 percent more tonnage than was the case a year ago and 122 percent more than the work in hand two years ago. Forty-one American yards were building merchant vessels in 1926 as compared with 49 in 1925 and 33 in 1924. Thirty-seven yards now have orders for new work as against 33 a year ago and 27 two years ago.

Thirty percent of the tonnage built in 1926 consisted of steam vessels, 15 percent of motorships and 55 percent of barges or non-propelled craft. Fifty-one percent of the tonnage was built on the Atlantic and Gulf coasts, 34 percent on the western rivers, 13 percent on the Great Lakes and 2 percent on the Pacific coast.

Sixty-one percent of the vessels now under construction consists of steam vessels, 15 percent of motorships and 24 percent of barges or non-propelled craft. Forty-nine percent of the tonnage now in hand is being constructed on the Atlantic coast, 27 percent on the Great Lakes, 18 percent on western rivers and 6 percent on the Pacific coast.

While the shipyards now have under construction a greater amount of vessel tonnage than has been the case at the first of any year since 1923 the new business placed in 1926 consisted principally of miscellaneous types of small vessels for domestic use, such as ferry boats, tug boats, barges, yachts, and the like, rather than sea-going vessels for passenger and freight service. The largest volume of tonnage of any one class of vessel ordered during the year consisted of Great Lakes bulk freighters, of which seven were ordered in 1926. Only two sea-going passenger steamships were ordered during the year, these being the 335-foot Red D steamship building at the yards of the Newport News Shipbuilding and Dry Dock Company and the 378-foot passenger steamship building at Cramp's for the Eastern Steamship Company, which is a duplicate of the one already under construction at that yard.

During the past year the Newport News Shipbuilding and Dry Dock Company delivered three passenger and freight steamships, of 5,649 gross tons each, to the Merchants and Miners Transportation Company, and two passenger and freight steamships, of about 6,000 gross tons each, to the Clyde Steamship Company, for whom they are now completing two other passenger and freight steamships of about 6,500 gross tons each. In addition to the above the Newport News yard has under construction the Red D liner and the 22,000-ton electrically driven passenger and freight steamship *California* for the International Mercantile Marine Company. At Cramp's the Matson liner *Malola*, of 15,000 gross tons, was launched last year and will be delivered early this summer.

The only private yards at which naval vessels are now under construction are the Fore River (Quincy, Mass.) Plant of the Bethlehem Shipbuilding Corporation, Ltd., where the airplane carrier *Lexington* is nearing completion, the American Brown Boveri Electric Corporation, Camden, N. J., which is completing the airplane carrier *Saratoga*, and Cramp's yard in Philadelphia which is building the 10,000-ton cruiser *Salt Lake City*.

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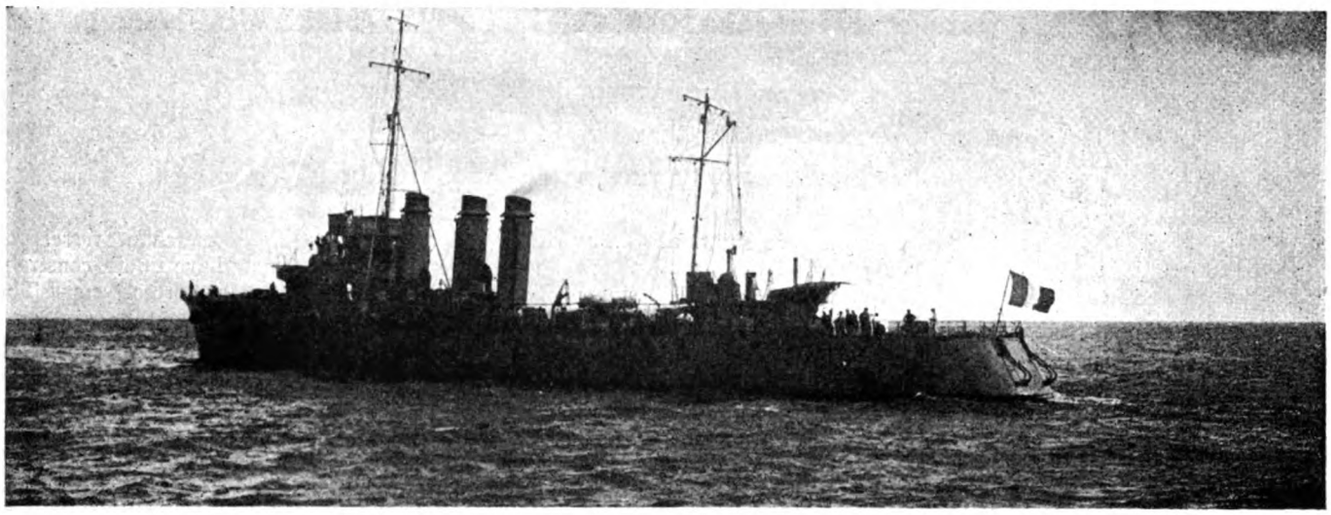


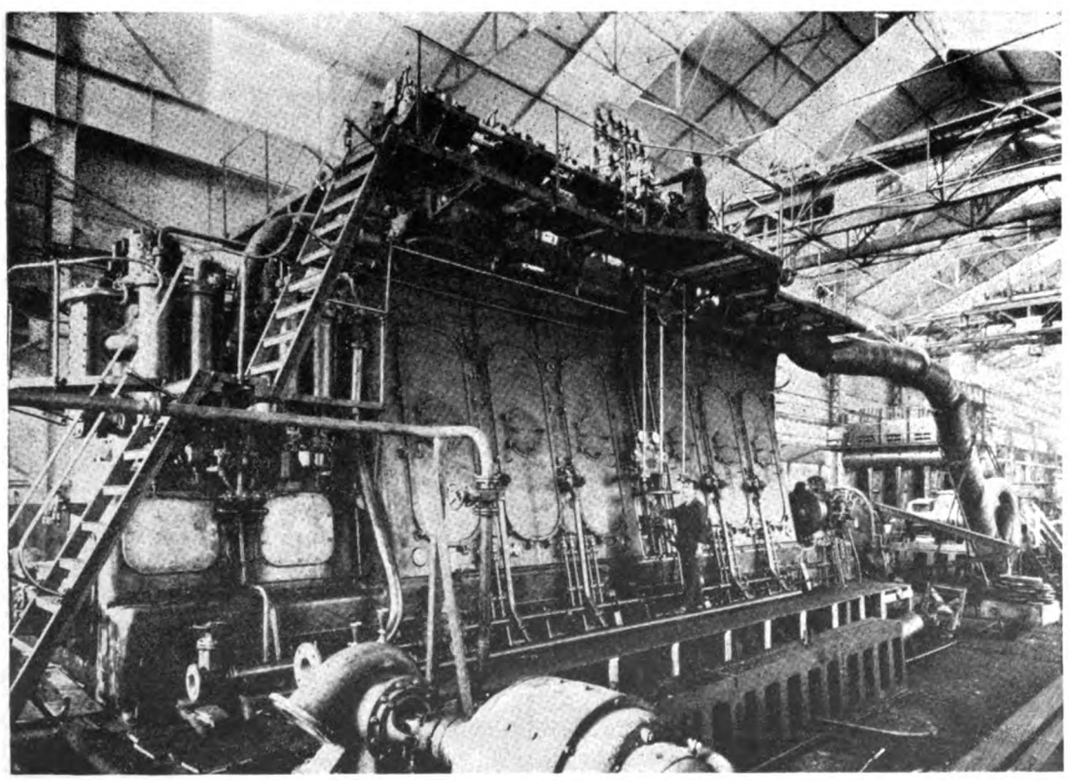
One of the 12 new 33-knot, 1,450-ton torpedo boats built by private French yards

French Shipping and Shipbuilding

General outlook at the close of 1926 and prospects for shipping and shipbuilding in 1927

FRENCH shipowners have carried on during 1926 their regular passenger and cargo services in spite of the general depression in the shipping trade and in the face of many difficulties. Among the latter may be mentioned the growing competition from foreign companies, the depreciation of the French currency as affecting the purchase of coal and oil-fuel and also the payment of port dues, etc., at foreign ports and the constant increase in seamen's wages. Despite all this and the lack of any financial assistance from the state, French companies succeeded in upholding the French national flag on the world's seas.

The French mercantile tonnage that aggregated 2,555,000 tons in 1914 and dropped to 1,880,000 tons after the war, has now increased to about 3,500,000 tons. Imports made by French vessels which represented only 22.56 percent of the total in 1913, worked out to 39.81 percent for 1924—the latest year for which returns are available—thus showing the results achieved, thanks to the increased attention paid to shipping problems by the bulk of the nation under the encouragement of the government.



One of the two main Sulzer engines for the Theophile Gautier

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The new 8,000-ton cruiser Duguay-Trouin, equipped with 4 Parsons turbines developing 110,000 horsepower

That 1926 has marked a notable improvement as regards the operation of the French shipping trade is indicated by the returns of the large companies such as the Compagnie Générale Transatlantique. The commercial success of the *Paris* has been steadily increasing, while the *France,* following her overhaul and her conversion to oil-burning, is also a profit-making ship. The big event of 1926 in connection with the French Line was the launch of the new 40,000 tonner *Ile-de-France* which is to be commissioned early in summer of 1927.

Notable improvement is also reflected by the returns of another big company, the Chargeurs Réunis. Passing to the third big French steamship company, the Messageries Maritimes, special interest centers around the completion of its building program which includes the construction of 10 new passenger liners. Of these 2 were delivered in 1925, 6 in 1926 and 2 are approaching completion. This firm has now resumed all of its pre-war services.

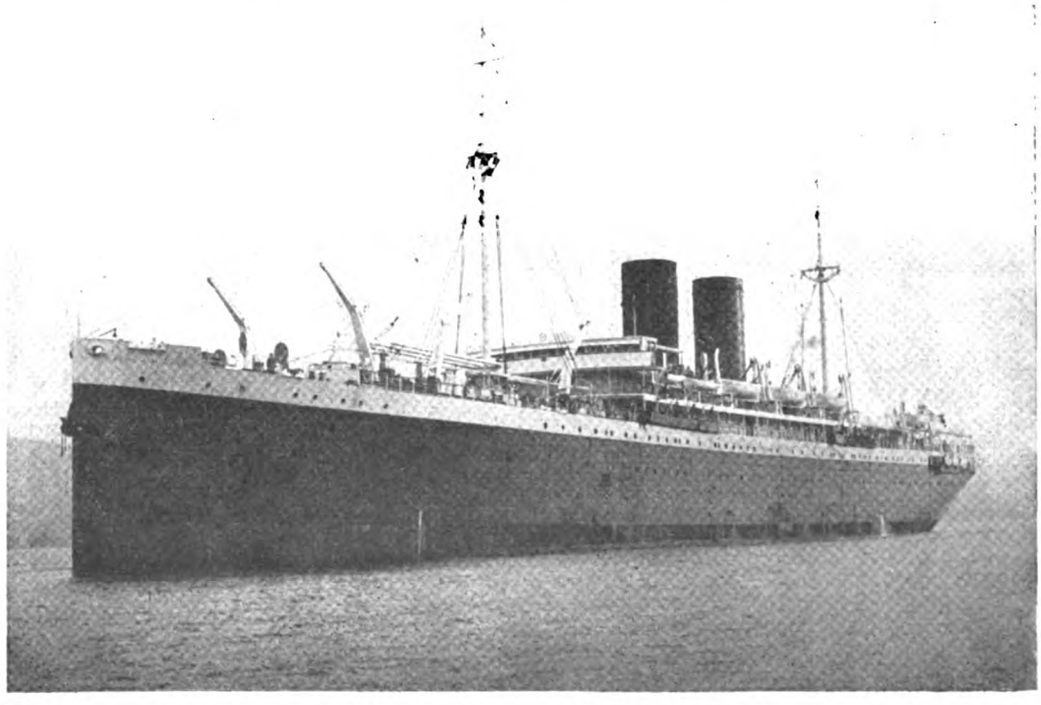
Cargo services have also showed a substantial improvement in the course of 1926 as appears from the steadily decreasing laid-up tonnage.

A feature of 1926 was the giving-up of the long planned organization of "Credit Maritime" or proposed loans to shipowners. In view of the prevailing financial difficulties, French shipowners have made up their minds to rely only upon themselves, and apart from the subsidies granted to a few companies in respect of the operation of mail services (the total yearly outlay being only about 100 million francs)—and which in some cases hardly covers the actual expenditure involved—French shipowners are receiving no assistance from the state, and there is no prospect for any change in the near future.

SHIPBUILDING CONDITIONS

The trend of the French shipbuilding industry in the course of 1926 has been featured by the small amount of orders placed by French companies and by the growing number of orders for new ships secured from foreign firms. This condition is illustrated by the fact that out of 15 merchant vessels above 1,000 tons gross that have been ordered from French shipyards during 1926, 6 vessels only are to be built to the account of French owners while 9 have been ordered by foreign concerns.

In addition to those 9 merchant vessels, 6 warships have



New passenger steamer Leconte-de-Lisle built by the Societe Provencale de Constructions Navale for the Messageries Maritimes

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been ordered by foreign navies from French yards, making a total of 15 important vessels ordered by foreign owners from French shipbuilders in the course of 1926.

The considerable assistance afforded to the French shipbuilding industry by foreign orders is to some extent a result of the depreciation of the franc, but chiefly is due to the strenuous endeavors of French builders to succeed in the international shipbuilding market by taking advantage of the good repute of French workmanship.

Vessels Delivered in 1926

Twenty-two important merchant vessels have been delivered by French yards during 1926, including 18 French and 4 foreign ships.

Among the vessels now under construction in France special interest centers around the *Ile-de-France*, the largest French vessel afloat. It is anticipated that this vessel—whose cost will considerably exceed that of the *Paris* will embody the latest improvements and that the luxury of her accommodations and decorative work will surpass the latter ship. The *Ile-de-France* is 241 meters long, 28 meters beam and 21.50 meters depth, with a gross tonnage of about 40,000. Accommodations are provided for 1,740 passengers and a crew of 800. The ship is to be propelled by four Parsons turbines to develop about 52,000 horsepower, steam being supplied by 12 double-ended and 8 single-ended boilers of the accelerated circulation Prudhon-Capus type burning oil fuel on the White system.

The French Naval Program

While foreign orders have afforded to French shipbuilders valuable assistance, the important work carried out for the French Navy has also been a very material help. Forty-two new warships included in the first stage of the French post-war naval program, viz., three 8,000-ton cruisers, six 2,400-ton flotilla-leaders, twelve 1,450-ton torpedo-boats, nine 1,450-ton and twelve 600-ton submarines have been completed during 1926, most of the construction of hulls and propelling machinery being contributed by private industry. The results of trials of these new ships have been especially satisfactory, speeds above 36 knots being recorded for some units.

Further orders have now been placed for new ships, including 10,000-ton cruisers, 2,600-ton flotilla-leaders, 1,495-ton torpedo-boats, and 1,500-ton submarines, these being the largest dimensions so far attained in France for vessels of each type.

The decision of the government to reduce the number of naval dockyards has also contributed to private industry.

No State Subsidy

Special mention has to be made of the fact that French shipbuilders no longer receive any subsidy from the state or the municipalities, since the expiration (in 1918) of the subsidy scheme of 1906. Many proposals have been made with a view to assisting the shipbuilding industry, but no decision has thus far been reached, in view of the difficult conditions of the state finances.

The only assistance at present in force is that relative to the construction of tankers, the subsidies being derived from a tax laid on all oil imports, in accordance with the law of January 10, 1925. But such assistance is granted to owners of tankers and not to shipbuilders and is effective only after the ships have been placed into service. So far it does not appear to have stimulated the construction of new French tankers. French shipyards have, however, built a number of foreign tank vessels.

Progress in Diesel Construction

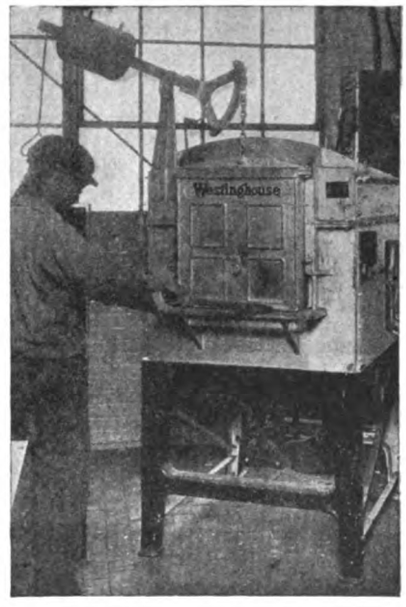
While French shipowners are still rather tardy as regards the adoption of Diesel engines for ship propulsion a notable change may be observed in that, while a year ago there was only one French motorship in service, another cargo vessel, a tanker and a passenger vessel are now ready for service, and four merchant motorships are under construction, to the order of French companies.

The Messageries Maritimes has ordered two Diesel-engined passenger liners and other French shipowners are likely to experiment with motor propulsion. As a matter of fact some companies would have no doubt already ordered motor vessels if it had not been for the financial difficulties and for the high shipbuilding costs.

While receiving so far but small support from French private shipowners, builders of Diesel engines in France have booked substantial orders from foreign firms and from the French Navy, so that several French Diesel works have been fairly busy during the past year.

New Westinghouse Electric Furnace

A NEW box or hearth type electric furnace particularly applicable to production work in plants for the heat treating of machine parts, and to tempering lathe and planer tools, dies and punches in tool rooms is now being manufactured by the Westinghouse Electric and Manufacturing Company.



New box type electric furnace

The furnace is constructed of a shell of heavy boiler plate, riveted and bolted to a structural steel frame, and heavy front castings. The heat insulations and the heating chamber are enclosed in the shell. The entire roof is assembled in a frame and bolted to the lower portion of the shell. A feature of this construction is that the roof may be lifted and swung to one side for the inspection or repair of the linings and the heating elements.

The direct radiating heating elements, made of nickel chromium, are protected and open, and are assembled in a frame of the same metal. They may easily be removed if necessary. A cast nickel, chromium floor-plate distributes the heat evenly, protects the bottom element, and forms a smooth surface for handling the material in and out of the chamber.

By means of automatic regulation the furnaces are automatically controlled within very close temperature limits, which can be fixed as desired up to the limit of 1,850 degrees F. This automatic regulation of temperature permits economy of operation by eliminating improperly heated charges, and reducing the operator's time required in attendance.

Three sizes are built having capacities, at 1,500 degrees F., of 100, 240 and 360 pounds of steel per hour, and with connected loads of 15, 27 and 40 kilowatts respectively. The smallest size uses single phase, 110-volt current; the middle size, single phase, and the largest size is designed for 1, 2 or 3 phase, 220-volt only.

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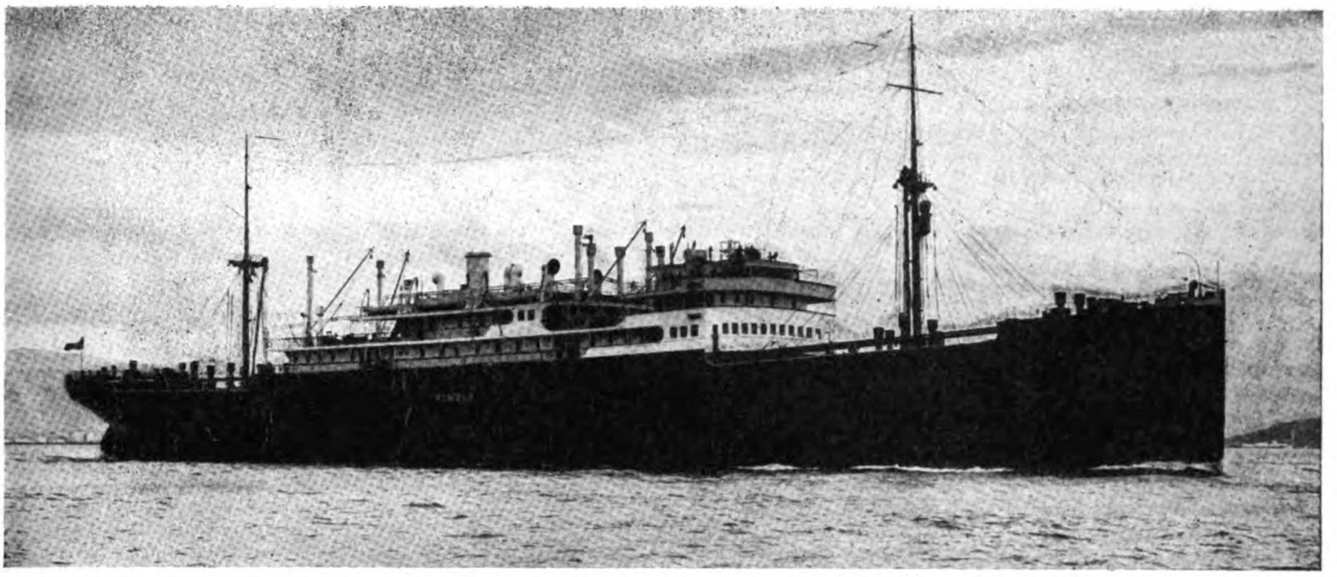


M. S. Romolo, the largest Italian motorship

Italian Passenger and Cargo Motorships

The year 1927 will be eventful for Italian shipbuilders because of the large tonnage of motorship construction

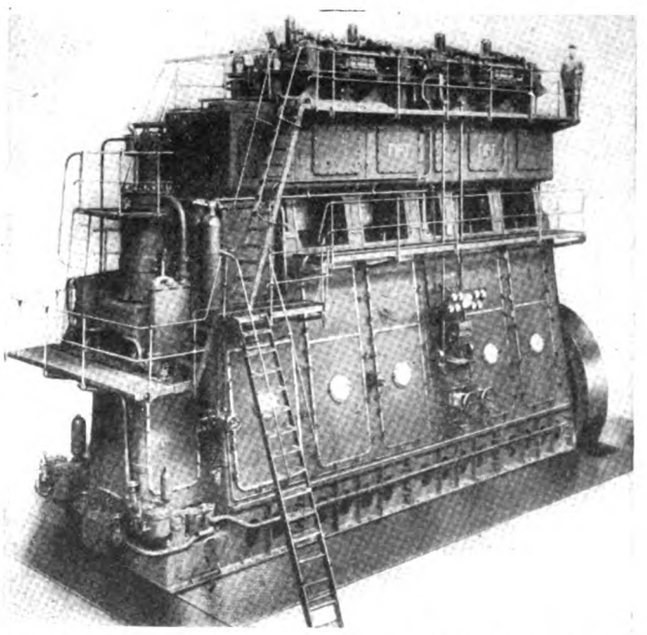
By Our Special London Correspondent

IT is natural in present circumstances that a good deal should be made of the fact that Italy is now the second motorship building country in the world, and that the biggest oil engined vessel yet projected is under construction at an Italian yard. The total tonnage of internal combustion engined craft on the stocks or in process of fitting out in the various Italian shipyards is in the neighborhood of 250,000 tons gross, a figure which is only slightly exceeded in Great Britain.

No doubt the assistance which the government has afforded is responsible for a good deal of the progress made, both in shipping and shipbuilding, but the whole hearted concentration upon motor propulsion by owners of all classes of tonnage is a little surprising. It has to be remembered, however, that Italy must import all the coal she requires, and that the majority of ships owned in that country are engaged on long distance services, on which the motor vessel is often able to show superiority over the coal-fired steamer.

The year 1927 will prove very eventful in the history of Italian shipbuilding, for in the spring the *Saturnia,* the first of two 22,000-ton motor liners for the Cosulich Line, will run trials, while in November or December the *Augustus,* which has a gross tonnage of approximately 32,000, and is far bigger than any other oil-engined craft, is due to sail on her maiden voyage.

From an engineering standpoint, the *Saturnia* has special interest, for, although the engines installed are exactly similar in cylinder size and number of cylinders to those fitted in the Royal Mail Steam Packet Company's *Asturias,* the power developed will be 20,000 shaft horsepower against 15,000 shaft horsepower in the British vessel. This increase has been made possible by driving the injection air compressors by separate Diesel engines, employing super-charges and running at a somewhat higher speed of revolution.



2,250 brake horsepower Fiat engine installed in the Maria—the largest engine of its type

In the *Augustus,* which is 711 feet in length, with a beam of 82.6 feet and has accommodation for over 2,000 passengers, four engines of the M. A. N. two stroke, double acting type are to be installed, each developing 6,250 shaft horsepower normally at 120 revolutions per minute but capable of an output of 7,000 shaft horsepower at 125 revolutions per minute for 48 hours on end. It is hoped to attain a speed of 21¾ knots

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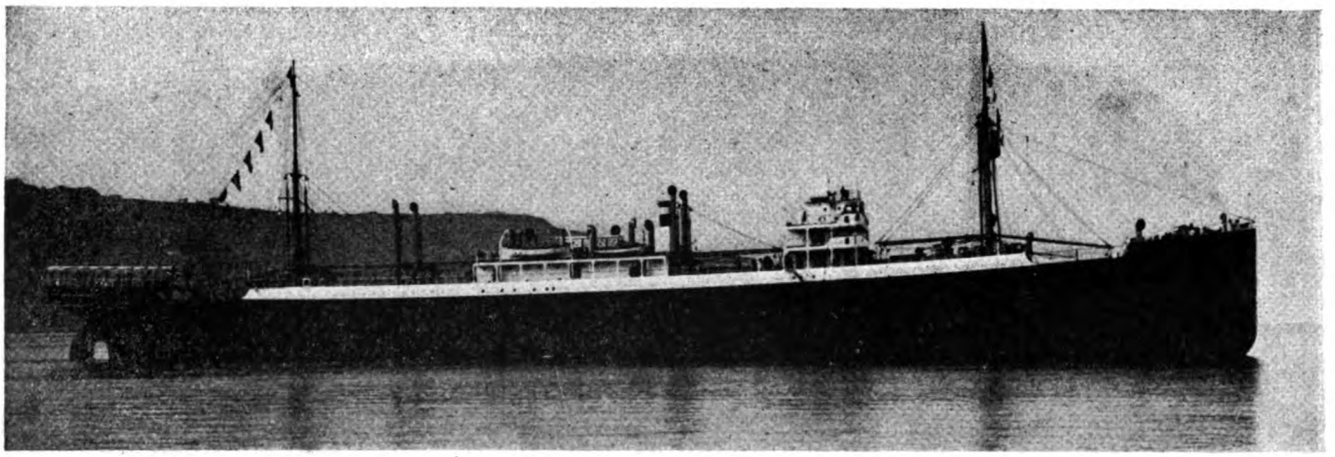


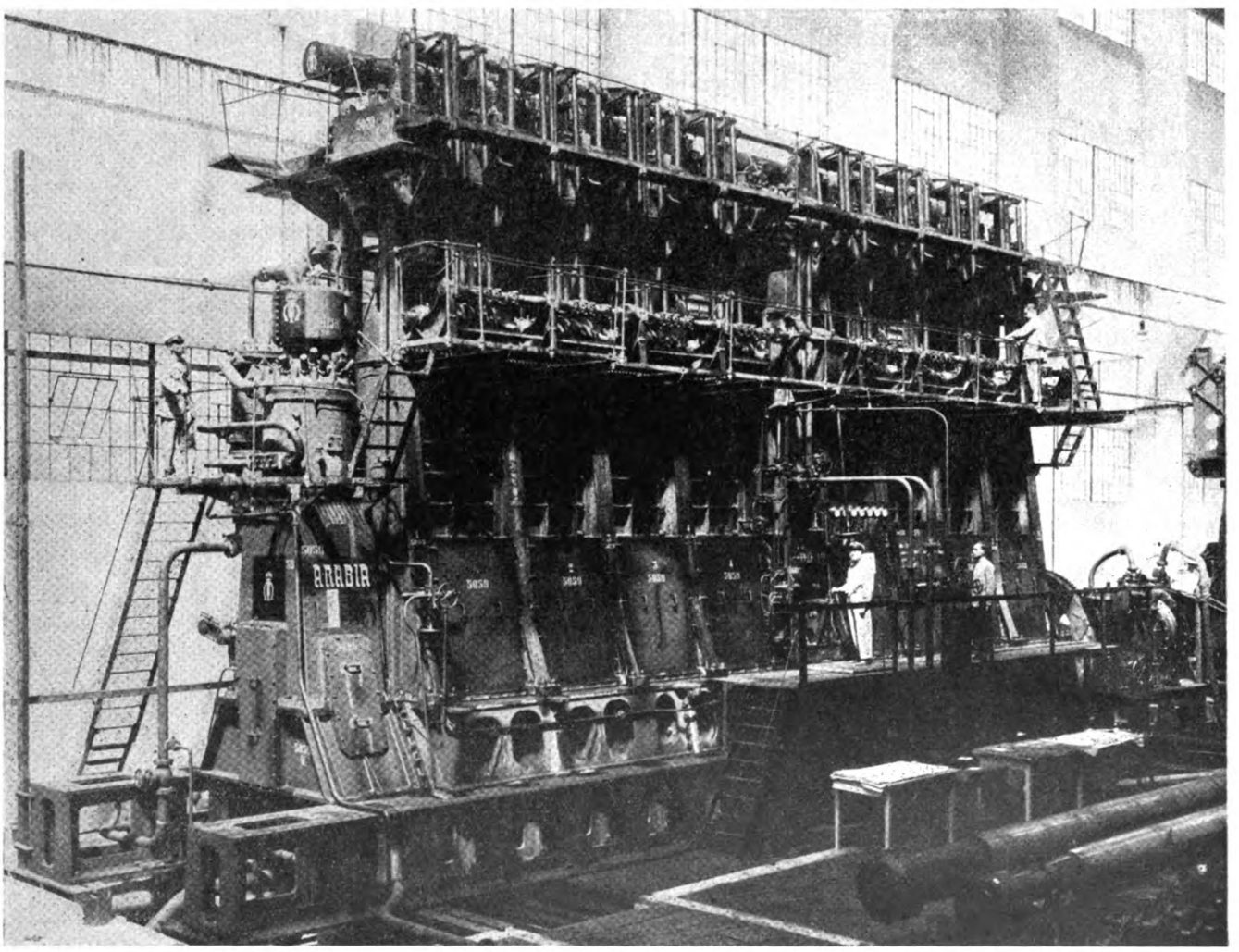
The motorship Arabia

with this liner, which is to the order of the Navigazione Generale Italiana of Genoa and will trade between Genoa, Naples and South American ports.

THE ROMOLO

Several interesting oil-engined ships have lately been completed in Italian yards. One of these, the *Romolo,* now on her maiden voyage, is the biggest yet turned out at an Italian yard, and has been designed for the regular service of the Lloyd Triestino (the old Austrian Lloyd) to India and China, These owners have evidently found it profitable to fit large cargo ships on this trade with a certain amount of very comfortable one-class accommodation. They already have two vessels on the service, the *Romolo* is the third, and the fourth will be completed very shortly.

The new mixed cargo and passenger liner, as the *Romolo* may be termed, is 484.7 feet in length between perpendiculars with a beam of 62 feet. The accommodation is for 66



Italian-built, 3,350 indicated horsepower standard engine of the four-cycle type installed in the Arabia

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passengers in one class, all berthed amidships, while 11,000 tons of cargo can be carried.

SUPERCHARGED ENGINES

The question of the employment of superchargers with Diesel engines is much debated and many designers consider that, if higher power is necessary, it is better to build the engine with larger dimensions rather than adopt supercharging, which involves bigger mean indicated pressures. In Italy, however, many of the new four cycle engined ships have supercharged machinery, and the *Romolo* is an example. There are two 6-cylinder Burmeister & Wain type motors with a bore and stroke of 740 millimeters and 1,200 millimeters respectively, and each of these, at 120 revolutions per minute, normally develops 2,500 indicated horsepower. An additional 20 percent is attained by supplying air under slight pressure from an electrically-driven blower so that the total output under these conditions is in the neighborhood of 6,000 indicated horsepower for the two engines.

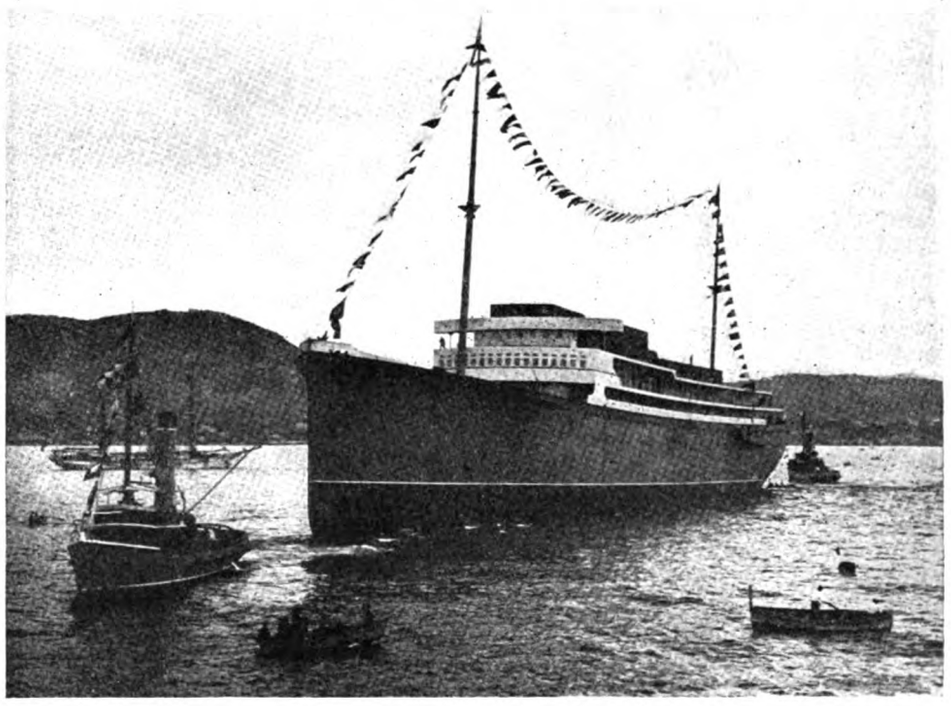
These motors may practically be taken as stock models, for it is a remarkable fact that at the Stabilimento Tecnico Triestino, where they were built, Burmeister & Wain type machinery is being produced for probably about a score of ships, and in every case a standard cylinder diameter of 29⅛ inches is employed. The Italians are following the original Scandinavian idea of fitting three Diesel-driven generators in the engine room for the provision of electrical power for auxiliary operation—electrical auxiliaries are practically universal in Italy—and in the case of the *Romolo* there are three 100-kilowatt plants, each driven by a 150 brake horsepower oil engine. The service speed of the *Romolo* is 13 knots, but with the supercharger in operation, she is able to maintain a higher average figure if needed.

THE FIAT-ENGINED MARIA

The development of the Fiat engine has been peculiarly interesting. Before and during the war, the famous motor car concern had entered upon Diesel engine construction in a relatively small way and, later, the business was acquired by the big Ansaldo San Giorgio concern. This latter did not altogether prosper and after the war the directors of the Fiat Company decided to repurchase and have spent very large sums in modernizing and enlarging their Diesel engine works in Turin, believing that a big future lies before the oil-engined vessel. Large numbers of orders have been placed for Fiat two stroke, single acting engines, and experiments have been carried out on a big single cylinder, double acting, two stroke type, which will, no doubt, reach the commercial stage in due course.

In the motor ship *Maria,* which has just been completed for the Cosulich Line, the Fiat Company has installed the biggest engine they have yet built, and it embodies some interesting new features. The designed power is 2,250 brake horsepower and the *Maria* is a ship of 8,200 tons deadweight, with a length and beam of 400 feet and 53 feet respectively. It is possible that the Cosulich Line, in ordering this new vessel, was influenced by the desire to obtain experience with the Fiat two stroke engine, for it is stated that if the two 33,000-ton transatlantic Cosulich liners, which are projected, are built, the propelling machinery would comprise a four screw arrangement, each shaft to be fitted with two 10-cylinder Fiat engines, practically the same in cylinder size as that fitted in the *Maria.*

With this engine, the chief feature of interest is that scavenging is effected through ports in the cylinder and the admission of the air is controlled by means of automatic valves. An unusual characteristic is that the cylinder heads are of steel, although the cylinders and liners are of cast iron. The piston heads are made of stainless steel. The engine has a cylinder bore of 750 millimeters with a piston stroke of 1,250 millimeters and the speed is about 100 revolutions per minute.



Launching of the N. G. I. passenger liner Orazio

THE INTERMEDIATE LINER ORAZIO

There was recently launched in Italy an interesting class of intermediate liner built to the order of the N.G.I., the owners of the *Augustus,* and intended, it is understood, for the Italian-Australian passenger and cargo service through the Panama Canal. This vessel and the sister ship *Virgilio,* which will shortly be launched, are 510 feet in length with a beam of 62 feet and a gross tonnage of approximately 11,500. Accommodation is provided for 61 passengers in first class cabins, 92 in second class cabins

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and 158 in 46 third class cabins, and in addition, 8,200 tons of cargo can be carried.

It might be thought that for such relatively large vessels as these, the four cycle, single acting engine would prove unsuitable. Actually, however, this is the type used—of Burmeister & Wain design—and a total power on two shafts of 8,800 indicated horsepower will be reached; this is practically the maximum attained in a four cycle, single acting engined ship. It is effected by fitting the standard 29⅛-inch diameter cylinder engine, and each of the two units has 8 cylinders, the speed of revolutions being 120 revolutions per minute and the piston stroke 1,500 millimeters. In the normal way, each of these motors can develop 4,000 indicated horsepower or 3,000 brake horsepower but here again superchargers are installed, and a maximum power of 4,400 indicated horsepower is reached with each motor, or 8,800 indicated horsepower total. It will be noted that the supercharger is called upon to increase the power by only 10 percent in this instance, probably because the owners do not consider it wise to go further in this direction. The *Orazio* is to maintain a speed of about 13½ to 14 knots.

What may be termed a standard Italian motor cargo ship has just been completed in the *Arabia*, built for the Societa Marittima Italiana. She is a craft of 9,300 tons deadweight, with a length of 430 feet and a beam of 55 feet 3 inches and with a speed of 11½ knots, seems to represent the average Italian shipowner's idea of a useful modern cargo vessel. Curiously enough, the single engine installed is exactly similar to the two in the *Orazio* but the output is only 3,350 indicated horsepower on account of the fact that no superchargers are installed and the speed of revolution is 95 instead of 120 revolutions per minute. It is thus apparent how the changes can be rung in powers of engines of similar types, by suitable variations.

It was, at one time, thought that Italian shipowners had plunged too heavily into motorship construction without having gained the necessary experience, but the results that have been achieved recently with the first oil-engined craft constructed in Italy appear to have been wholly satisfactory, and there will apparently be a steady development in motorship building. It should be added, however, that one or two of the leading concerns, such as the Lloyd Sabaudo, are still building geared turbined passenger vessels.

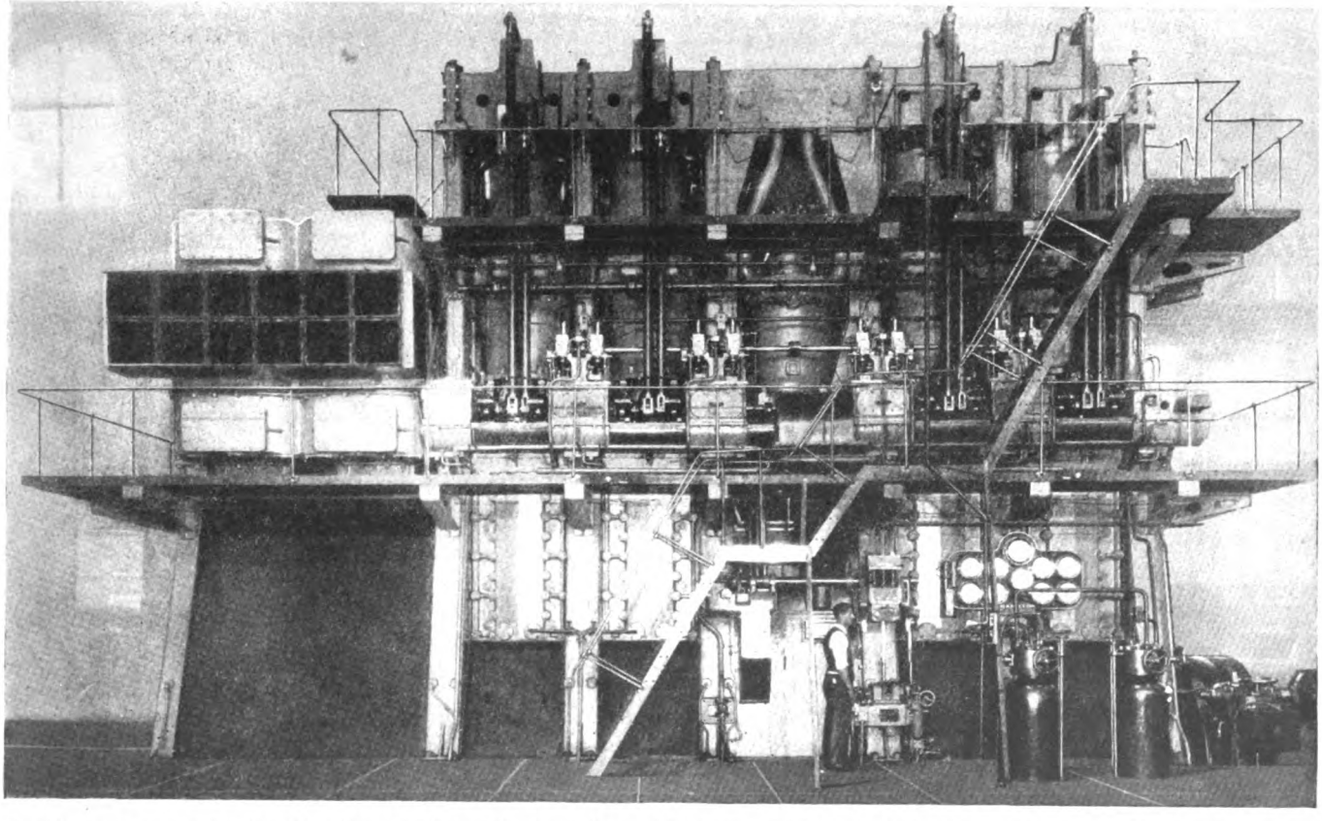
Observations on Marine Safety*

By H. H. Raymond†

IN the shipping industry, I believe the majority of accidents are chargeable to hand labor, such as handling material, tools, material falling on persons, stepping on or striking against objects, falling objects and such causes which will not be prevented by more mechanical guards or better safety devices. It is my opinion that these accidents can be prevented by better supervision and more effective education.

The foremen should instruct the men under them, warn them of danger, tell them the right way and the best way, and teach them to be more careful in their relations with fellow workmen. We should also hold to strict account those to whom authority is delegated to inspect equipment. Insist on inspections being made frequently and replacements made of defective parts. Keep a record of the date when equipment and parts are installed and replaced. When equipment or parts are found to be worn out or just able to stand the strain, do not use again, but replace with new equipment or parts immediately.

*From a paper presented before the marine section at the fifteenth annual congress of the National Safety Council, Detroit, October, 1926.
†President, Clyde-Mallory Steamship Companies, New York.



Double acting, two cycle, Hamilton-M.A.N. Diesel engine designed to develop 3,300 shaft horsepower at 95 revolutions per minute. This engine, built by The Hooven, Owens, Rentschler Company, Hamilton, O., for the United States Shipping Board, is shown undergoing tests in the builders' shop.

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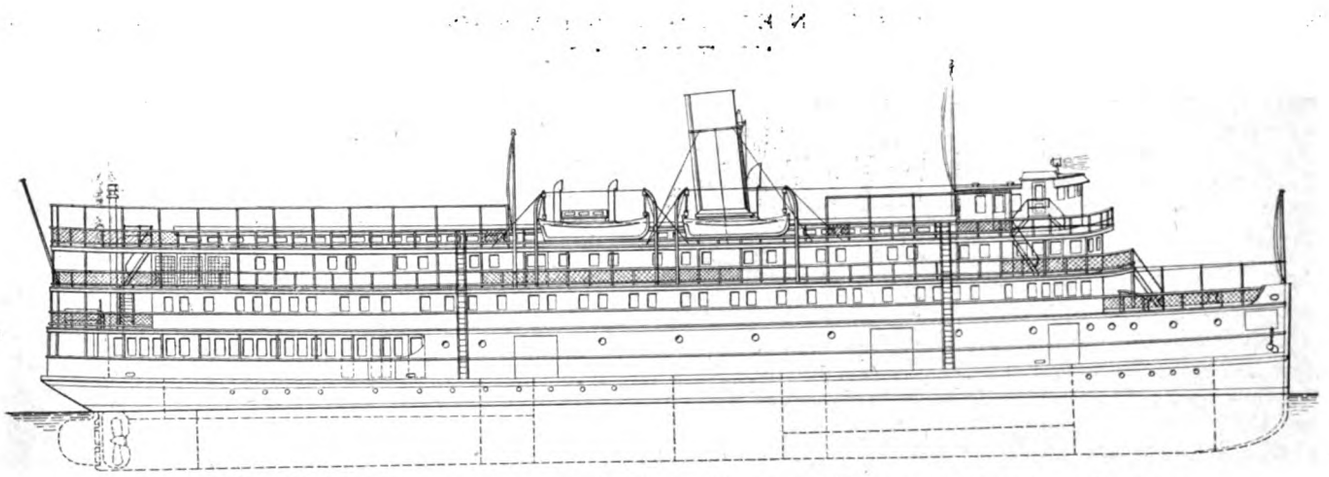


Outboard profile of new passenger steamer for the Baltimore and Philadelphia Steamboat Company

The New Ericsson Line Steamer John Cadwalader

Single screw passenger and freight steamer built by Pusey and Jones for Baltimore and Philadelphia Steamboat Company

By A. M. Main*

THE single screw steam *John Cadwalader* was designed and built by the Pusey and Jones Company of Wilmington, Del., for the Baltimore and Philadelphia Steamboat Company of Philadelphia, Pa. Her construction and details were supervised by Cornell and Matthews, naval architects of Philadelphia, who represented the owners. The new steamer will be employed in the freight and passenger service between Philadelphia and Baltimore, Md., via, the Chesapeake and Delaware Canal.

The construction of the vessel and her equipment is such that she can be used in bay and sound service.

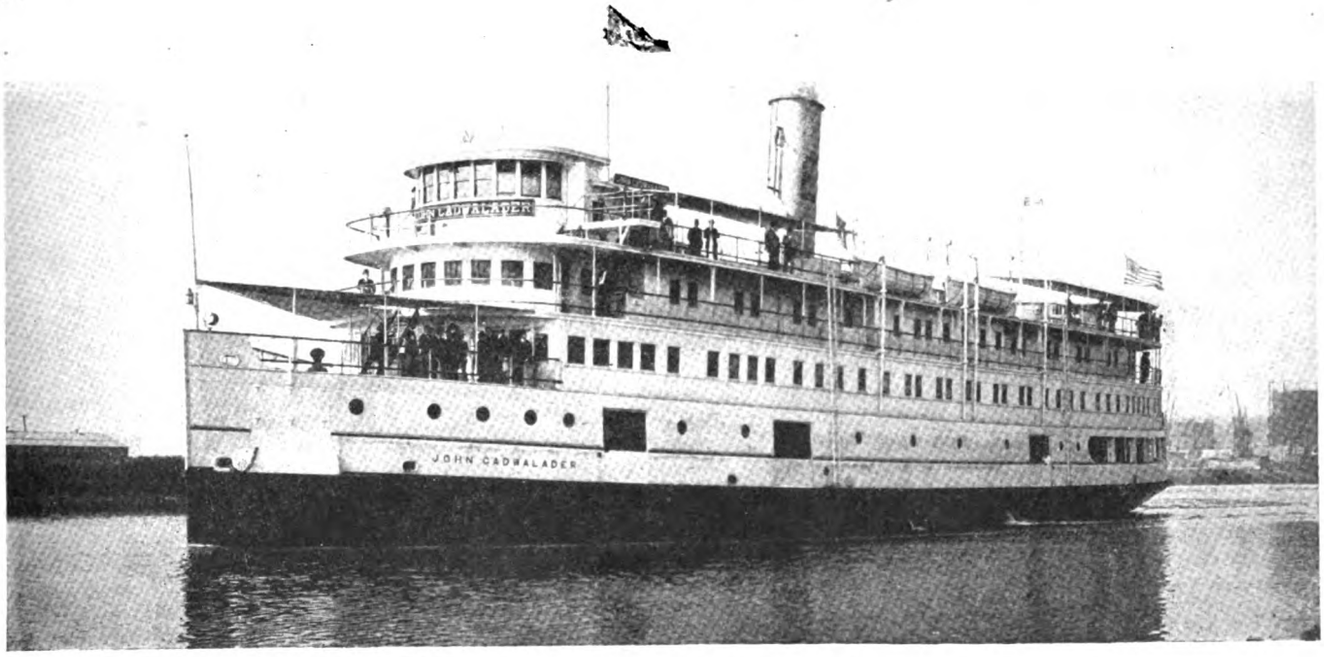
Her principal dimensions and particulars are as follows:

Length over all	230 feet 0	inches
Length between perpendiculars	219 feet 0	inches
Beam, extreme	45 feet 0	inches
Depth, molded	15 feet 10	inches
Light draft, fully equipped	7 feet 11½	inches
Load draft, with 440 long tons deadweight not to exceed	11 feet 0	inches
Gross tonnage	1,478	
Net tonnage	805	

* Consulting naval architect. The Pusey and Jones Company, Wilmington, Del.

Propelling Machinery

Propulsion is by a four cylinder triple expansion reciprocating engine with cylinders 21 inches, 32 inches, 35 inches and 35 inches diameter by 24-inch stroke, developing 1,750 indicated horsepower, built by the Harlan and Hollingsworth Corporation in 1903. Steam is supplied at 210 pounds per square inch working pressure by two Babcock and Wilcox marine type watertube boilers each having 3,046 square feet of heating surface and 80.7 square feet of grate surface.



Passenger and freight steamer John Cadwalader

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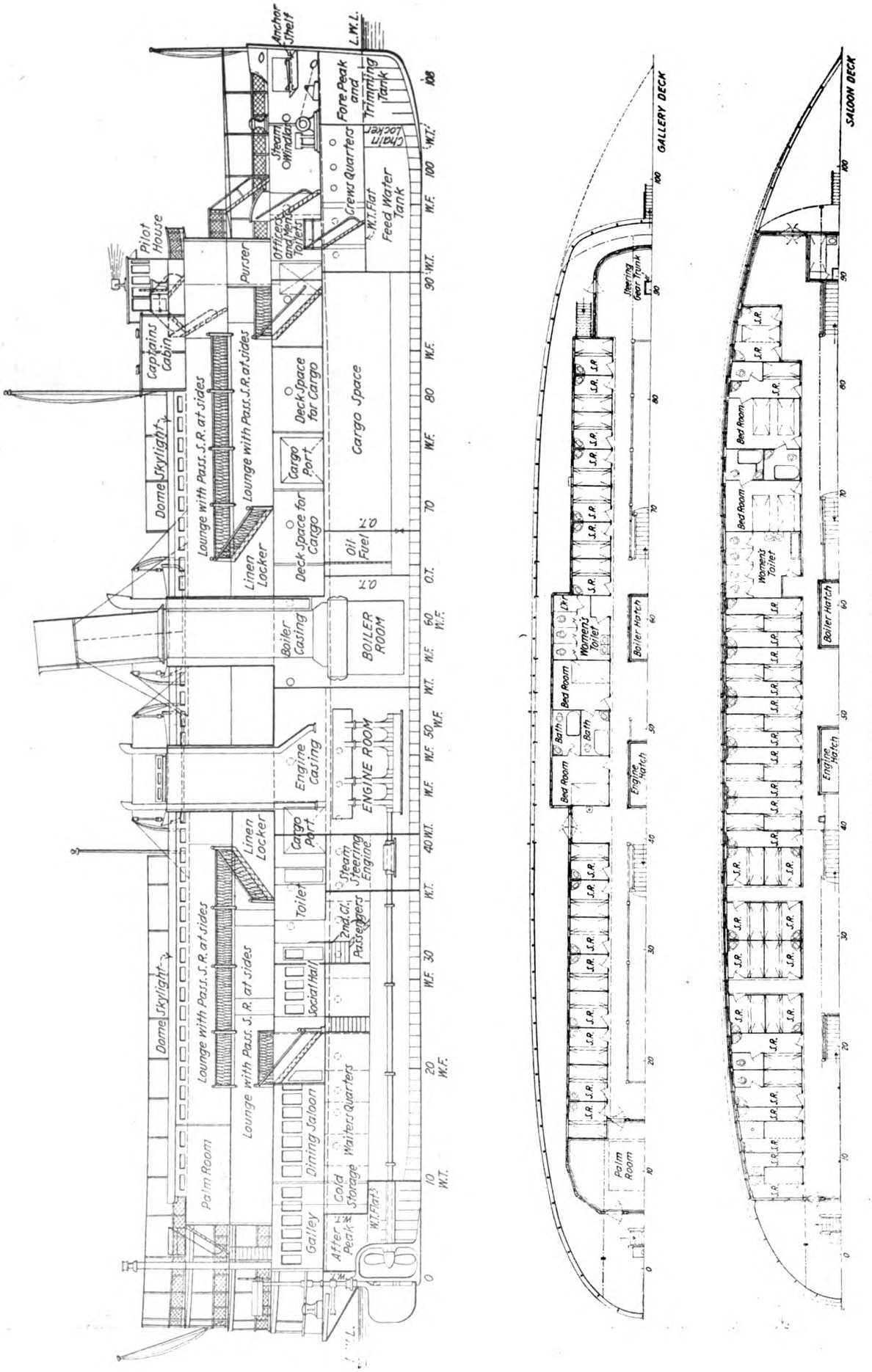

Inboard profile and deck plans of new Ericsson Line steamer

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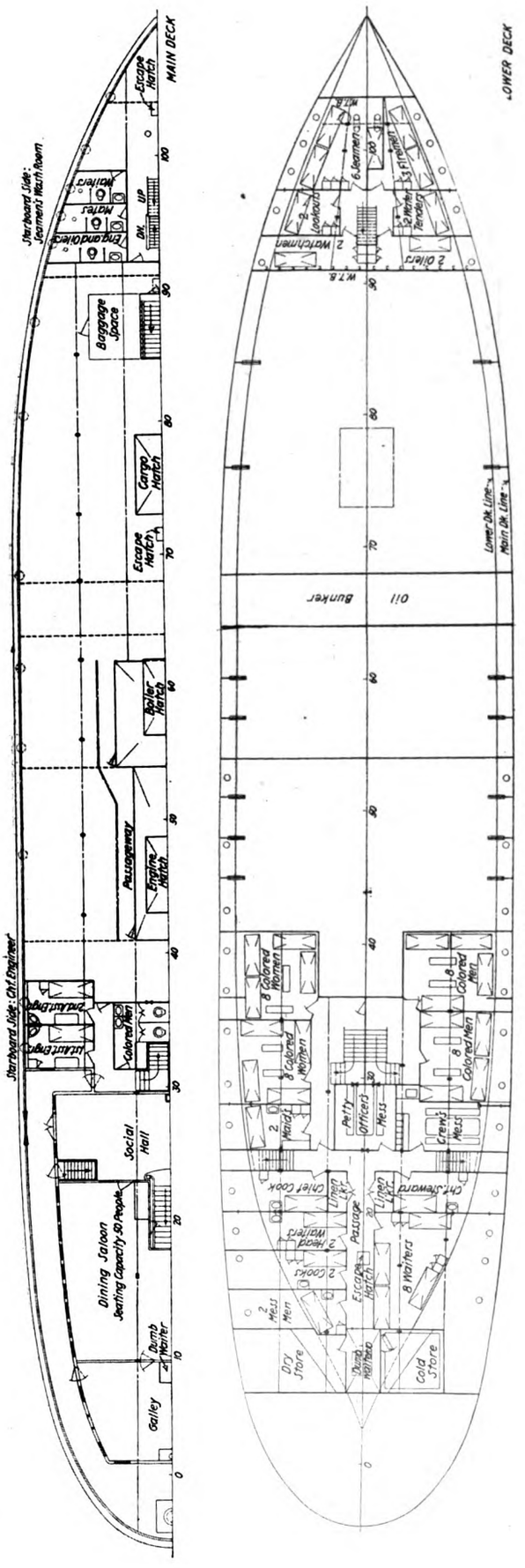

Lower deck plans of new Ericsson Line steamer

The boilers are arranged for burning oil and are fitted with the Babcock and Wilcox Mayflower type of burners.

The propeller is 9 feet diameter by 11 feet 3 inches pitch with a blade area of 39 square feet. The speed of the vessel, loaded to 11 feet on her trial trip, was 14¾ miles per hour at 160 revolutions per minute.

HULL CONSTRUCTION

The hull is of steel subdivided transversely by 5 watertight bulkheads and 2 oiltight bulkheads. The stern frame, rudder frame and stern shoe piece are steel castings. The main deck is of steel as is also the lower deck in the crew's quarters, forward of the hold and abaft the engine room. The decks are supported by girders and pillars as shown on plans.

The side of the vessel from the main to the saloon deck is of steel from stem to the aft end of the freight space, supported by steel frames and web frames at the freight ports and at intervals between the ports. Abaft the freight space the side is continued by a steel bulwark at the main deck and a steel frieze plate at the saloon deck supported by steel tee bar stanchions.

The bulkheads between the freight space and passenger quarters aft and the crew's quarters forward are of steel as are also all bulkheads in the crew's quarters on the main deck. The stairway from the main deck forward to the saloon deck is in a steel enclosure.

The carlins of the saloon deck are of wood. In the freight space they, and the under side of the saloon deck, are covered with galvanized sheet iron. Steel beams are fitted under the saloon deck at each web frame and all are supported by steel girders and pillars arranged to facilitate the handling of freight.

Freight carried on the main deck is trucked in through side ports. Freight in the hold forward is handled through a large hatch in the main deck, served by an elevator operated by a steam winch. A separate elevator operates a single pull through the forward part of the hatch. The elevators have 8-inch by 6-inch double cylinders.

DECK MACHINERY

A 6-inch by 6-inch steam steering engine is located in the engine room over the thrust block and controlled by shafting from the steering column in the pilot house. The quadrant on the rudder head is under the main deck and operated by chain and wire rope leads from the steering engine which is of the combined hand and steam type.

The rudder stock is extended through the main and saloon decks and can be operated by a right and left hand screw gear on the saloon deck.

The steam windlass is located on the main deck forward. The anchors are housed in hawse pipes passing through the main deck and shell. The chain cable is 1⅛ inches in diameter. A warping capstan on the saloon deck is operated by a steam windlass and by hand power through capstan bars.

For warping aft a 5-inch by 7-inch reversible dock type steam capstan is located at the aft end of the main deck. All of these deck machines are of Hyde Windlass Company make.

Fuel oil is carried in a transverse bunker forward of the boiler room and divided by a longitudinal bulkhead. All necessary valves and heating coils are fitted, as are also a pneumercator gage and pump, and a kerosene tank and hand pump for starting the fires.

A Lux fire extinguishing system is installed for smothering fire under the floor plates of the boiler room.

Feed water is carried in a deep tank abaft the fore peak bulkhead and under the crew's quarters.

Fresh water for drinking, culinary and ablutionary pur-

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poses is carried in circular tanks located in the shaft space abaft the engine room.

Separate pumps are provided for each system.

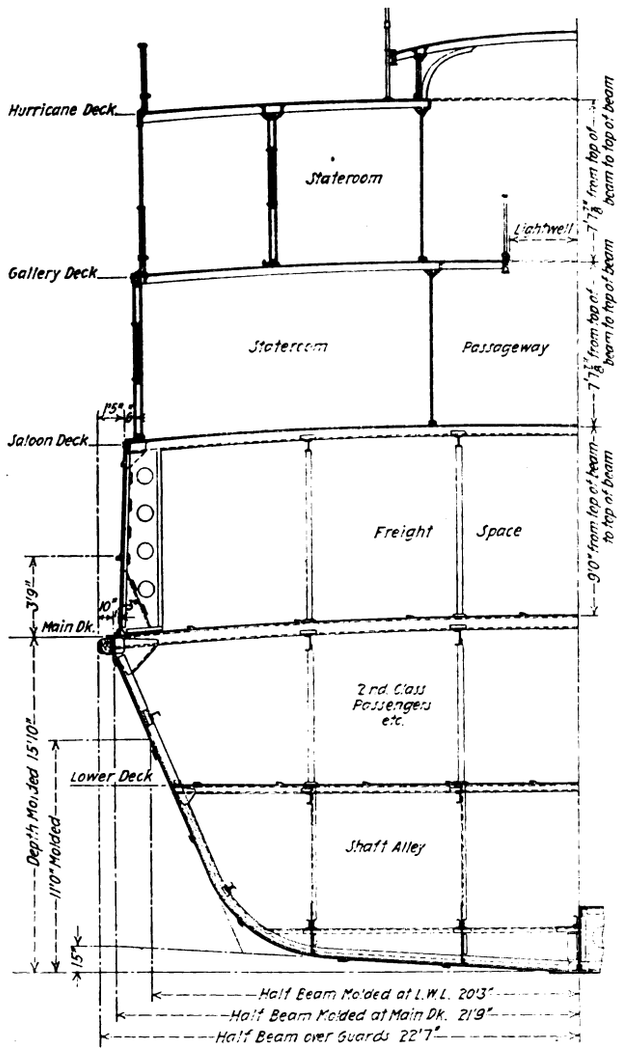
The engine room and boiler room auxiliaries are as follows:

One condenser, one circulating pump, one Warren main feed pump, one Warren auxiliary feed pump, one donkey and fire pump, one Warren sanitary pump, one cold fresh water pump, one hot fresh water pump, one ice water pump, one bilge pump, one injector, one Griscom-Russell feed water heater, one Griscom-Russell fresh water heater, two Griscom-Russell oil heaters, two Weir horizontal fuel oil service pumps, one Viking rotary oil transfer pump, and one hand pump and kerosene tank for starting fires.

The thrust bearing is of the horse shoe type.

Deck Houses

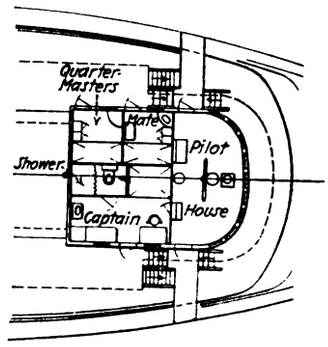
The house on the main deck, containing the entrance hall, dining saloon and galley, is of wood construction, the interior of the galley being lined with galvanized sheet iron. A steel ventilating trunk extends from the galley up to and above the hurricane deck. The galley smoke pipe is carried up in this trunk.



Midship section

An elevator connects the galley with the store rooms on the lower deck. The galley is equipped with a range, steam table, stock boiler, Faspray dish washer, egg boiler, coffee urns, plate and cup warmer, refrigerators, and butcher's block, supplied by the Globe Supply Company of Philadelphia. Two motor driven fans located in the after bulkhead of the dining saloon exhaust air from that room driving it into the galley.

Above the saloon deck level, the superstructure is of wood construction with engine and boiler hatches or casings built of steel extending above the hurricane deck dome.

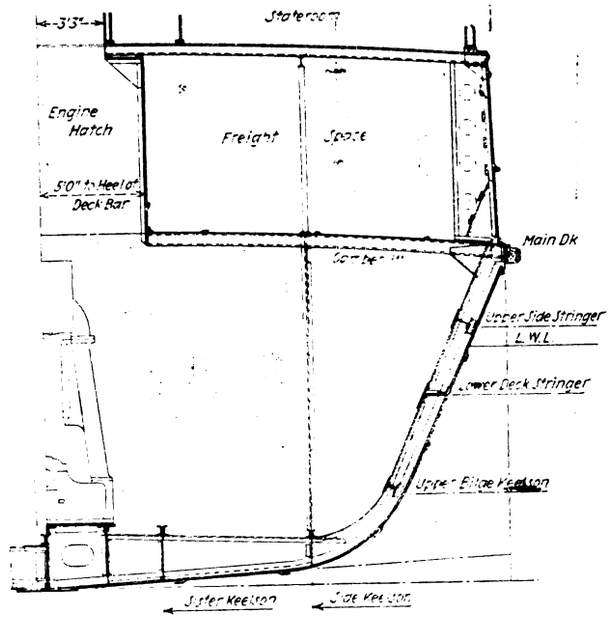


Section of hurricane deck

The superstructure decks are supported by steel girders and pillars with steel beams at suitable locations.

In way of the boat davits steel fore and aft stringer girders are fitted with steel supports to the saloon deck and steel athwartship ties passing through the dome and attached to the engine and boiler casings.

The outside of all wood houses is framed and paneled in white pine, the windows are in two parts with solid sills to prevent leakage. Mahogany blinds fitted to all windows are in two parts and made to slide up. The internal walls and bulkheads are of Haskelite as is also the sheathing on the inside of the house studding. The toilet partitions and walls between staterooms and toilet shower, etc., are of plymetal.



Section through engine room

The overhead ceiling in the dining saloon, entrance hall, music or palm room, dome over the gallery deck and bed rooms are paneled with Vehisote in wood moldings.

The interior of the dining room is paneled in pine and painted. The entrance hall is paneled in mahogany. The saloon and gallery walls, music room and bed room walls have panels of Haskelite with suitable moldings.

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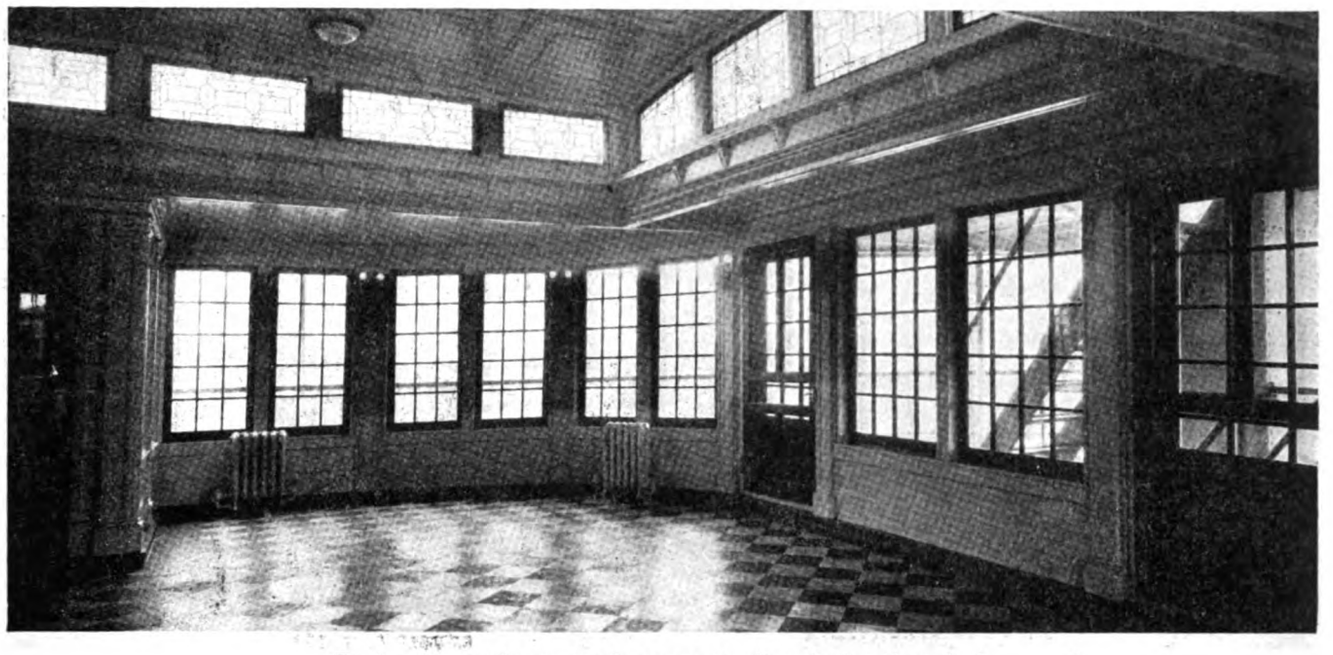


Enclosed veranda, or music room, at aft end of gallery deck

The pilaster caps and cornice moldings throughout are of hardwood, no plaster or composition being used. The gallery deck dome has art glass transom lights. The berths and beds are all of metal, of Southern Rome make. The joiner tongued and grooved decks are all covered with canvas as are also the tops of the domes and houses.

FLOOR COVERINGS

The gallery deck light well and main stairs have art metal balustrades surmounted by a mahogany rail. The floor covering in the galley is of Belgian tile. In all crew's quarters on the lower and main deck, and in the public and private toilets, bathrooms, etc., the floor is covered with Selbylith, having a cove base.

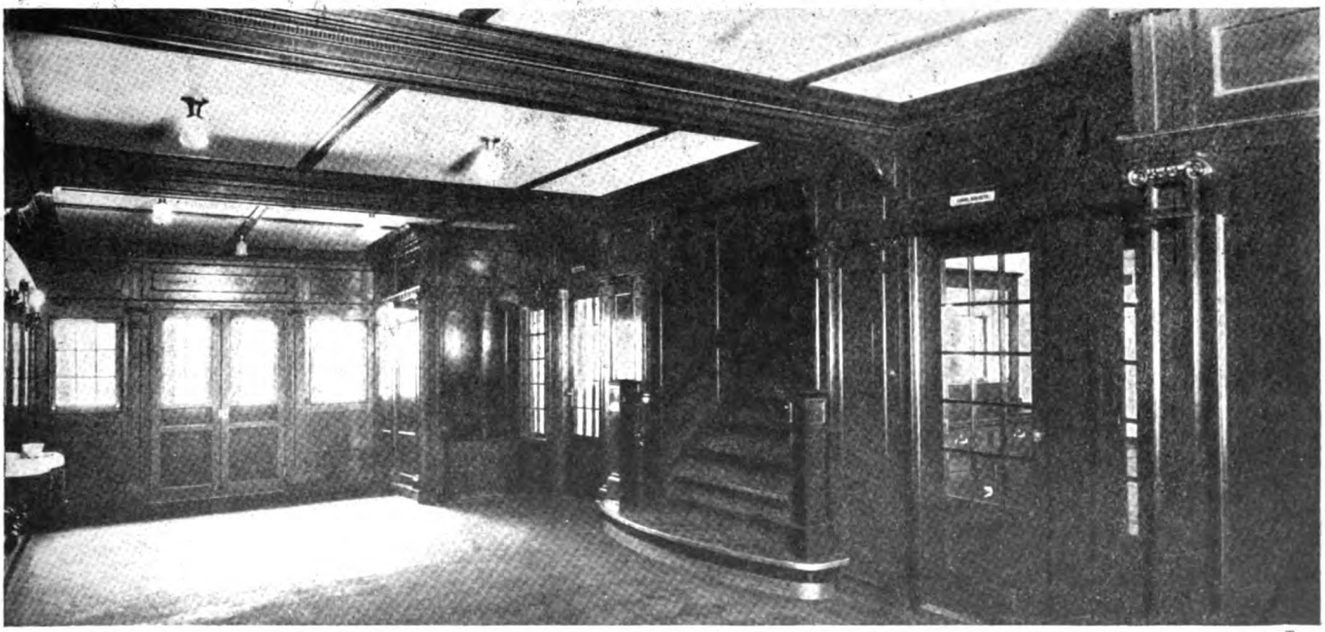
The social hall and dining room floors are covered with a cork composition tile laid on Selbylith. The main stair treads and music room floor are covered with rubber tile, all laid by the Selby-Battersby Company. The crew's toilets and wash rooms have a Briggs mastic flooring. The officers' quarters and pilot house have linoleum on the floor.

The staterooms, bed rooms, saloon and gallery decks inside of the houses will have carpeted floors, the upholstery furniture, bedding, crockery, etc., being furnished by the John Wanamaker Company of Philadelphia.

All staterooms have hot and cold running water. Five alcove drinking fountains are provided at suitable places where running ice water can be had. There is also an outlet in the engine room and on deck, the water being circulated through ice cooled coils by a pump. The plumbing fixtures throughout are up to date and were supplied by the Speakman Company of Wilmington.

HEATING, LIGHTING AND SAFETY APPLIANCES

The vessel is heated by steam. She has all the fire detecting systems and fire extinguishing systems required by U. S. Steamboat Inspection Service and in addition the Lux system for extinguishing oil fires in the boiler room.



Entrance hall. Doors to the right lead to the dining saloon

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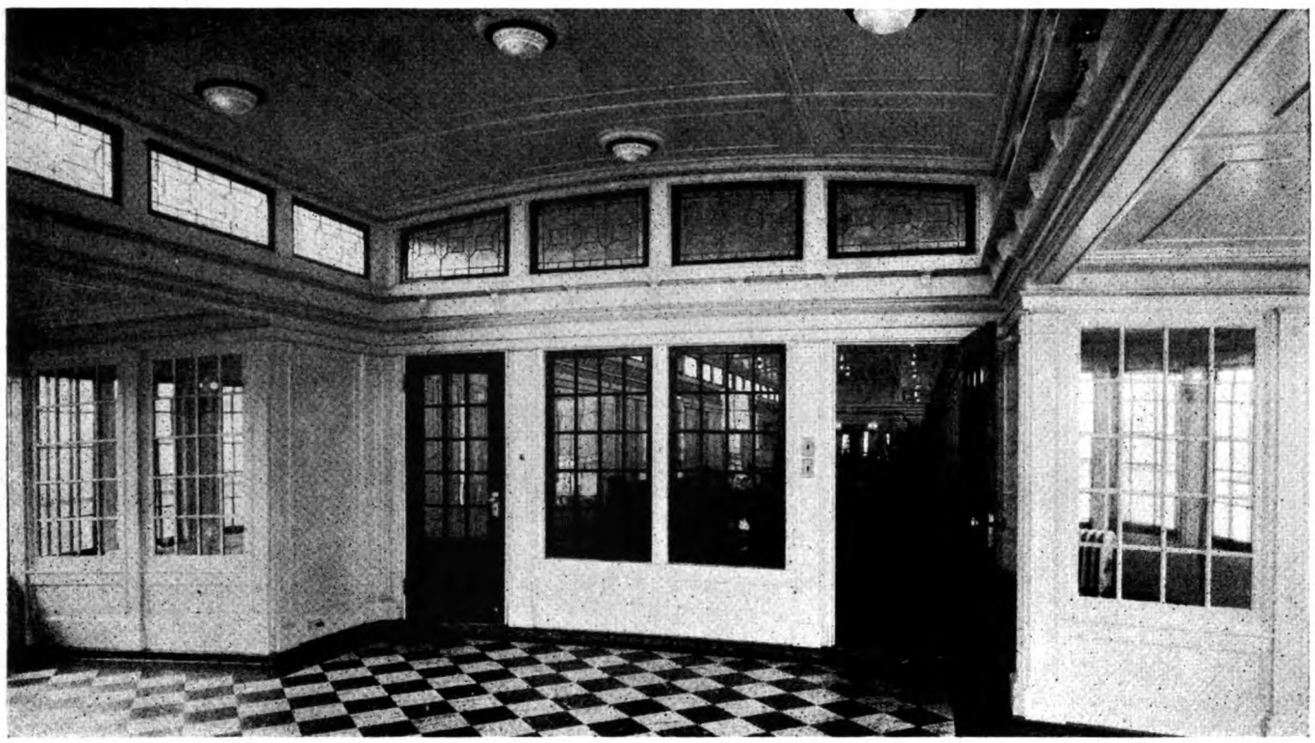


Looking forward from music room on gallery deck

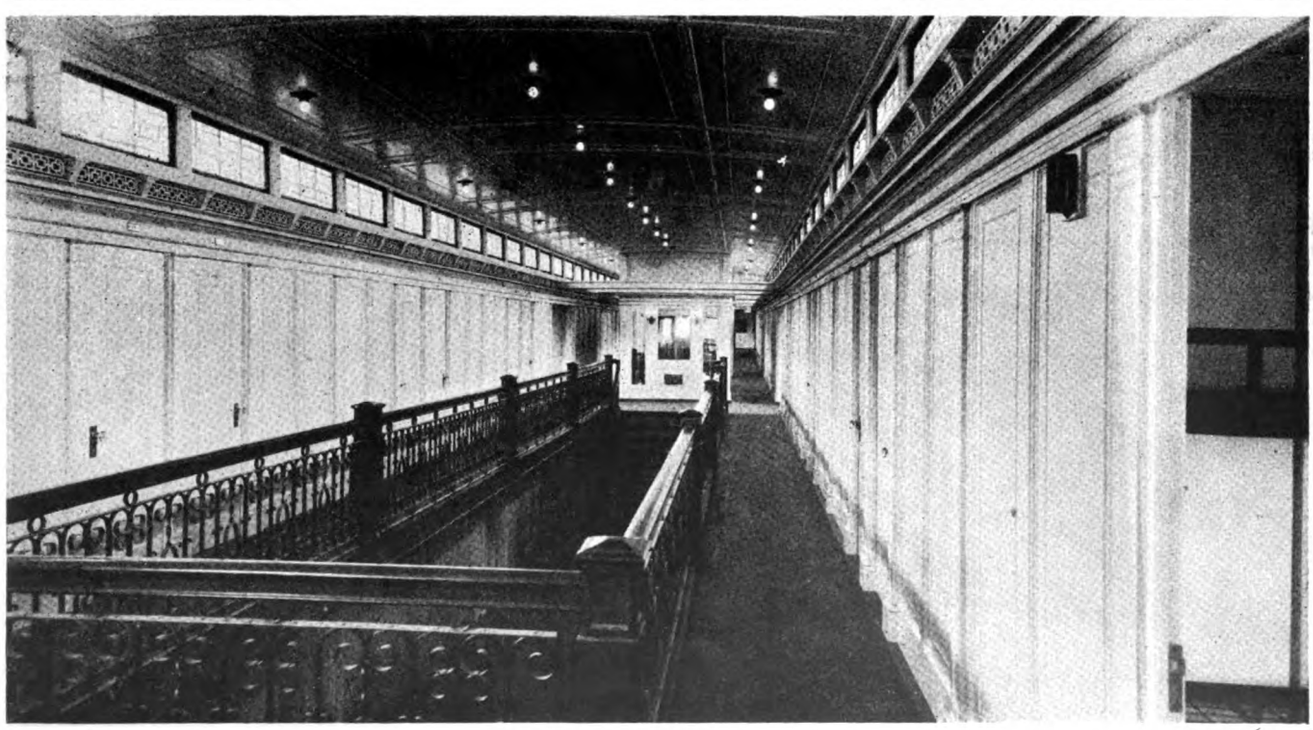
The electric generating plant consists of two 25-kilowatt Terry turbine driven sets with General Electric dynamos. The electric fixtures are in keeping with the general finish of the rooms and saloons, each room having an outlet for a fan. The wiring and layout is in accordance with the latest practice. The fire detecting and alarm systems, telegraphs on deck and in the pilot house for engine room communication, speaking tubes, call bells and annunciator, whistle control and wiring to all motors were installed by Charles Cory and Son, Inc.

The vessel is equipped with 4 lifeboats, 6 rafts and other life saving, navigating and such equipment as required by the latest rules of the U. S. Steamboat Inspection Service.

The plans of the vessel show the general arrangement and the photographs give an idea of the finish of the public spaces.

It will be noted that there are very few inside rooms or inside toilets but for which special ventilation is provided.

The majority of the bed rooms have twin beds and there are several staterooms having one berth. The lower berth



Light and air well on gallery deck

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in all double berth staterooms has a reading light, as in the case with all beds and berths in the single berth rooms.

ACCOMMODATIONS

The accommodation for passengers and crew is as follows:

Outside bed rooms	with	bath room	8 x 2 = 16	passengers
" staterooms	"	W. C.	6 x 2 = 12	"
" "	"	shower	2 x 1 = 2	"
" "	"	2 berths	56 x 2 = 112	"
Inside "	"	2 berths	6 x 2 = 12	"
Outside "	"	1 berth	11 x 1 = 11	"
Inside "	"	1 berth	2 x 1 = 2	"
Total first class			91 rooms	167 passengers.

On the lower deck in four compartments there are 16 berths for second class men and 16 women.

Total second class passengers	32
Total passengers in berths	199

The officers and crew are as follows:

DECK DEPARTMENT	ENGINE DEPARTMENT	STEWARD'S DEPARTMENT
1 captain	1 chief engineer	1 purser
2 mates	2 assistant engineers	1 assistant purser
2 quartermasters	2 oilers	1 steward
2 watchmen	3 firemen	1 head waiter
2 lookouts	2 watertenders	8 waiters
6 seamen		1 chief cook
15	10	2 cooks
		2 messmen
		2 maids
		19

On this vessel there are 121 wash bowls with running water, 8 bath tubs, 7 shower baths, 5 drinking fountains, 38 water closets and 4 urinals.

The cooks, steward and waiters are located on the lower deck aft convenient to the galley and dining saloon. The crew are in the forcastle on lower deck forward. The engineers rooms are on the main deck near the engine room entrance. The pursers are on the saloon deck. The captain's and deck officers' rooms are on the hurricane deck.

TRIAL TRIP

The *John Cadwalader* had a trial trip on the Delaware River with the vessel loaded to 11 feet draft on which the desired speed was obtained. The vessel handled nicely, answering her rudder quickly as is required for canal work.

The new canal has made possible the use of a vessel of this size and the *John Cadwalader* marks a decided step forward in size, type of accommodation for passengers and rapid handling of freight on service between Philadelphia and Baltimore. The new vessel is in every way equal to the fine vessels of this type operating on the Chesapeake Bay.

The Most Important Thing in Welding*

By S. W. Miller†

IN fusion welding the procedure used must be correct if success is to be desired. Procedure is made up of a number of elements, of which the following may be considered as essential: Design, materials, methods, operators, supervision and tests.

Design.—This must be such as will enable the welder to weld easily and cheaply and to do good work.

Materials.—These must be such as will result in clear, sound welds, so that both the base metal and the welding rod must be selected with this in view. For general work materials that are hard to weld should be avoided.

Methods.—This refers particularly to the use of suitable jigs, fixtures, clamps and other tools and to the order and way in which the various parts of the whole operation, including the preparation and finishing, are performed. Any of these things that make it easier to get better work, are an advantage, and each design should be studied with this in view.

Operators.—Much depends on the operator but if he is handicapped by improper design, materials, or methods, the best results cannot be expected, no matter how good he is. I disagree with the idea that the operator is the most important link in the chain. I do not think that any one of the items mentioned is of superior importance to the others.

Supervision.—Competent and careful supervision is necessary and the supervisors must be competent to perform their duties. The supervisor should know not only the actual welding operation, but all other parts of the work.

Tests.—A weld cannot be inspected internally to determine its quality, but it has been amply demonstrated that tests can be devised that will prove the integrity of the welded structure, provided the other links in the chain receive the proper attention. When the procedure is proper, safe results are always obtained.

Procedure control in welding has shown its value in many cases not only in better work, but in reducing the cost and increasing the production. I strongly believe that it is the most important thing in welding.

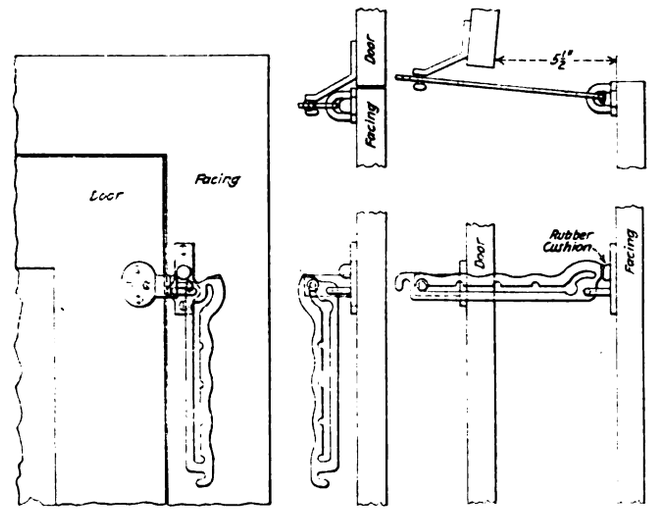
* From a paper presented at the International Acetylene Association Convention, Chicago, November 11, 1926.

† Consulting engineer, Union Carbide and Carbon Research Laboratories, Inc.

New Locking Door Hook

THIS simple and useful addition to the list of ships' hardware has been devised and patented by Mr. N. Christiansen of the Newport News Shipbuilding and Dry Dock Company.

As is clearly indicated by the illustrations, the door may be held in several positions by the safety catch but the



Sketches showing (left) door closed with hook disengaged, (center) door closed with hook locked and (right) door partly open with hook locked

latter can only be operated by the inmate of the room as it is necessary to close the door in order to disengage it. When protection from intrusion is not desired the device can be used in the same manner as an ordinary door hook. The addition of the rubber buffer to prevent rattling is a feature which will be instantly appreciated by all who have had experience in sea travel.

The device has been given the trade name of the "Dixie Hook."

WATERFRONT IMPROVEMENTS at San Francisco to cost about $1,000,000 have been approved by the State Board of Harbor Commissioners.

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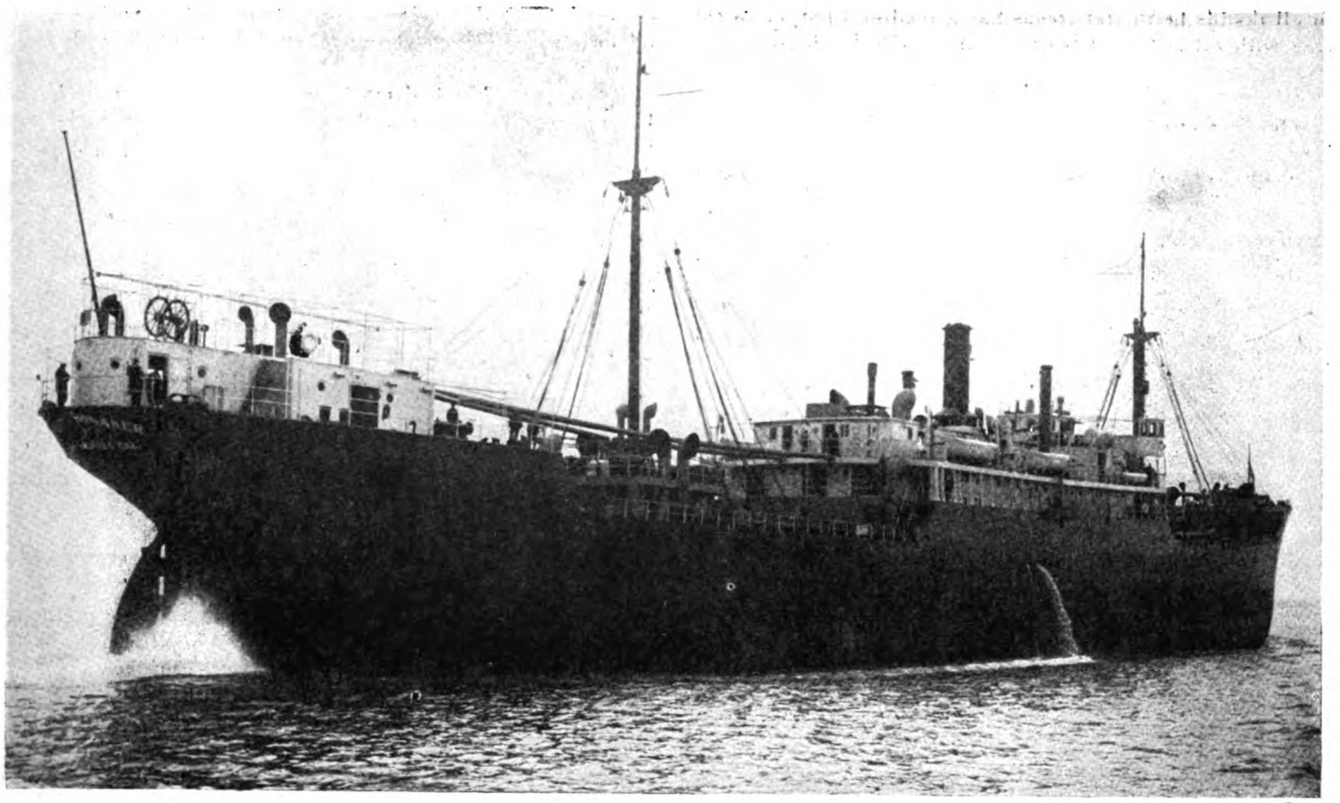
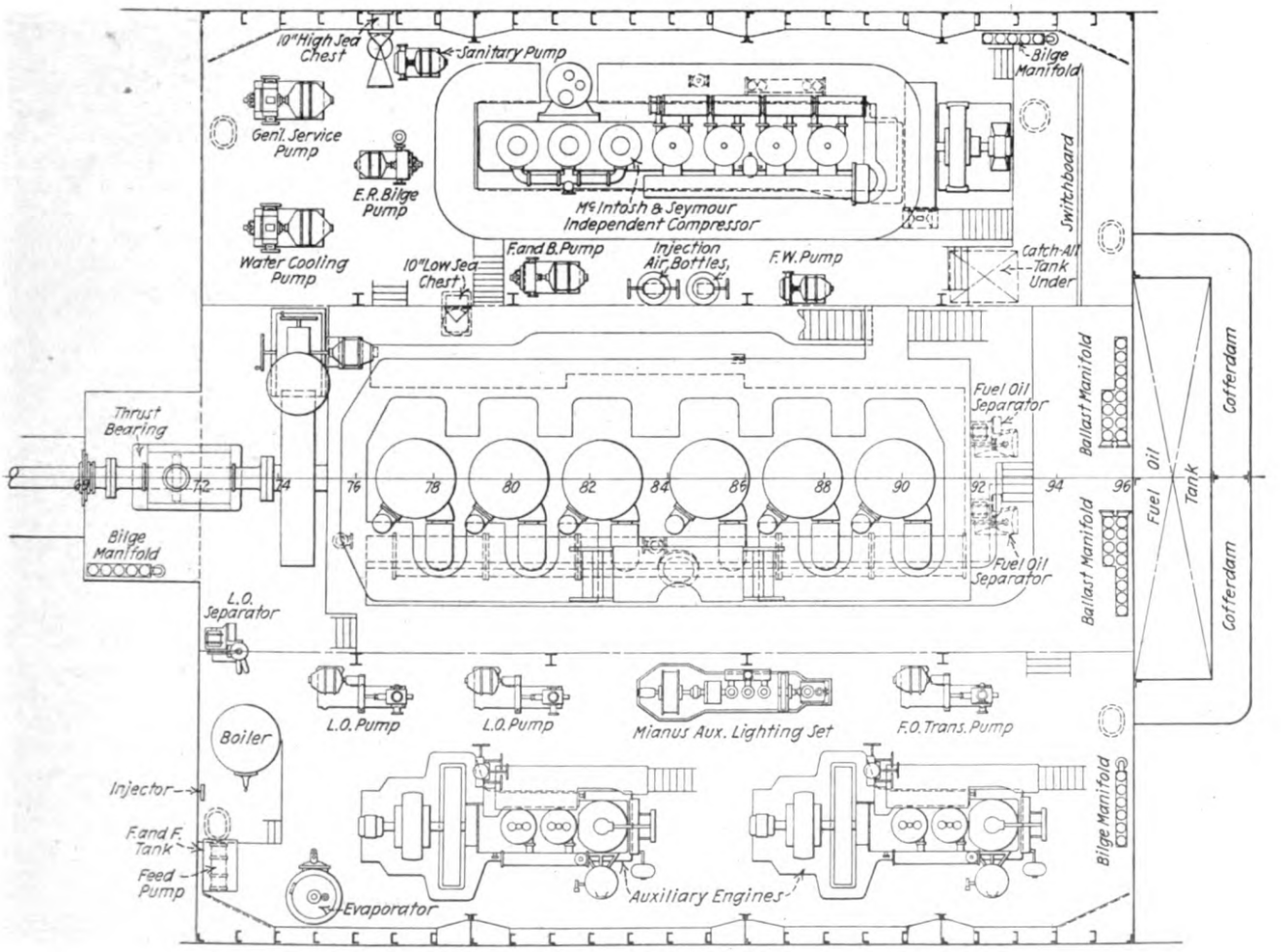


M.S. West Honaker, the Shipping Board's second converted motorship



Plan of the West Honaker's engine room

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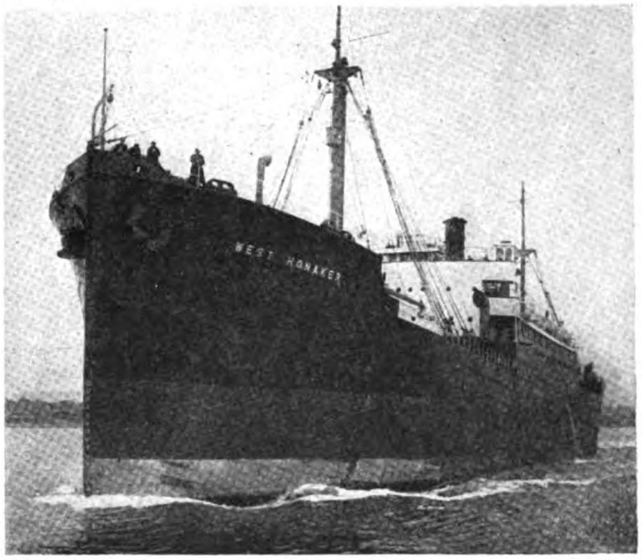
The Shipping Board Motorship West Honaker

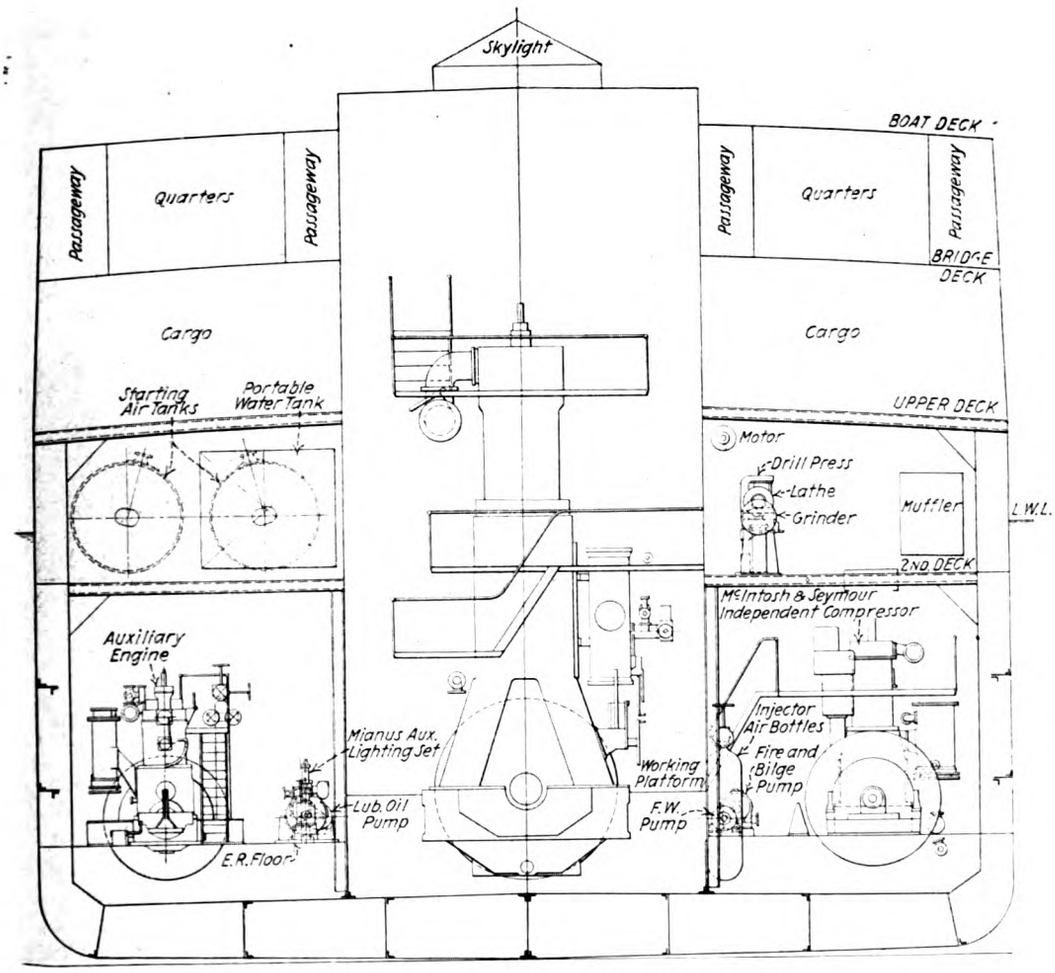
McIntosh and Seymour four cycle single acting engine of 2,700 brake horsepower installed by Fore River Plant of Bethlehem Shipbuilding Corporation



Bow view of the West Honaker

THE *West Honaker*, the second of the Shipping Board's converted motorships to be completed, was given a successful sea trial in Massachusetts Bay on November 29.

Completed in 1920 by the Los Angeles Shipbuilding and Dry Dock Company, the *West Honaker* was originally equipped with a triple expansion steam engine of approximately 2,500 indicated horsepower and three watertube boilers, the designed sea speed being 10½ knots. This machinery has now been removed and a McIntosh and Seymour 6 cylinder 4 cycle single acting engine installed in its place. While the work of conversion, which was performed by the Fore River plant of the Bethlehem Shipbuilding Corporation, was in progress the ship was generally overhauled and repaired, and a limited amount of passenger accommodation added.



Section through engine room, looking aft

The *West Honaker* is a two deck, single screw vessel, with poop, bridge and forecastle erections, of a type very similar to the *Tampa*, which was described in MARINE ENGINEERING AND SHIPPING AGE for December, 1926. The general dimensions and particulars of the vessels are given on page 22.

As was the case with the *Tampa*, the vessel has been very completely fitted out and is in every respect an excellent cargo ship. In addition, spacious and comfortable quarters for 14 passengers have been arranged on the bridge deck.

The main interest in the vessel centers, of course, on her propelling machinery. The main engine, built by the McIntosh and Seymour Corporation of Auburn, N. Y., is of

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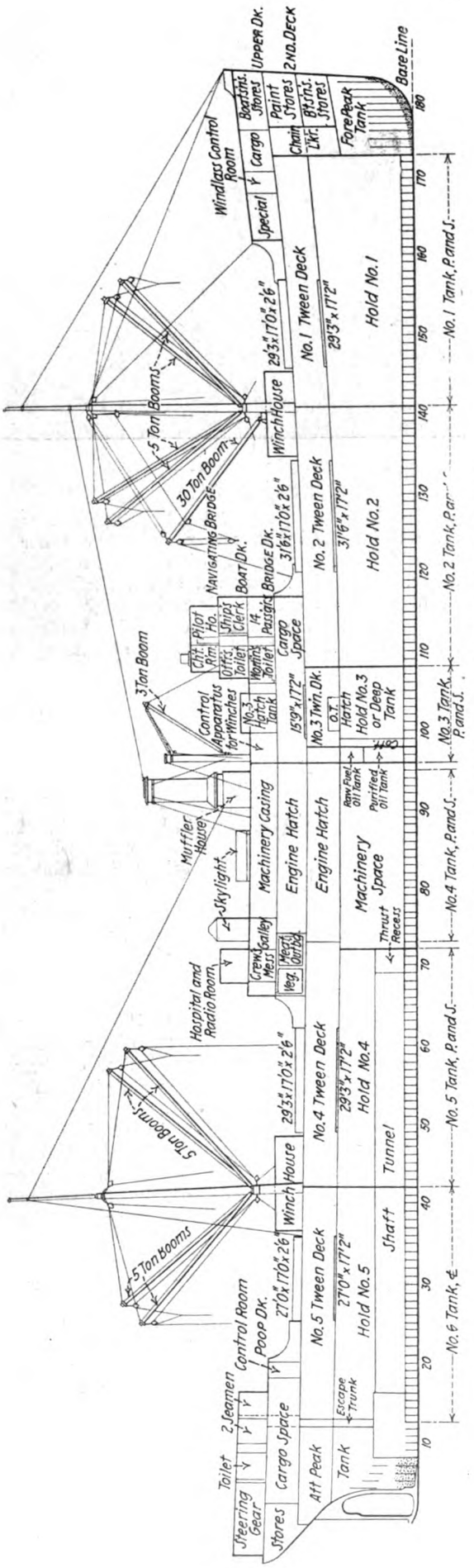

Inboard profile of Shipping Board converted motorship West Honaker

PRINCIPAL DIMENSIONS OF THE WEST HONAKER

Length overall	425 feet 9 inches
Length between perpendiculars	410 feet 0 inches
Beam, molded	54 feet 0 inches
Depth, molded	29 feet 9 inches
Load draft	23 feet 11¼ inches
Load displacement	12,086 tons
Corresponding deadweight	8,006 tons
Gross tonnage	5,424
Net tonnage	3,372
Cargo capacity, bales, excluding deep tank	349,674 cubic feet
Fuel oil capacity, double bottom	886 tons
Capacity of deeptanks, salt water	674 tons

Officers of the West Honaker

the four cycle single acting type and has six cylinders 32 inches in diameter and 60 inches stroke. At 95 revolutions per minute a brake horsepower of 2,700 is developed. Air injection of fuel is used, the air being supplied by an independent compressor. This engine was described and illustrated in MARINE ENGINEERING AND SHIPPING AGE for June, 1926.

The independent compressor unit consists of a 4 cylinder McIntosh and Seymour engine, single acting four cycle,

Shipping Board and other officials on the West Honaker's trial trip

having cylinders 17 inches in diameter and 24 inches stroke, which develops 400 brake horsepower at 200 revolutions per minute. This engine has connected to it, at the after end, the 3 stage main air compressor and at the forward end a 75 kilowatt, 240 volt generator.

There are two auxiliary compressors and generators, each driven by a McIntosh and Seymour 2 cylinder, 4 cycle single acting engine with cylinders 13⅝ inches in diameter by 18 inches stroke, developing 108 brake horsepower at 275 revolutions per minute. The auxiliary generators have each a capacity of 75 kilowatts at 240 volts

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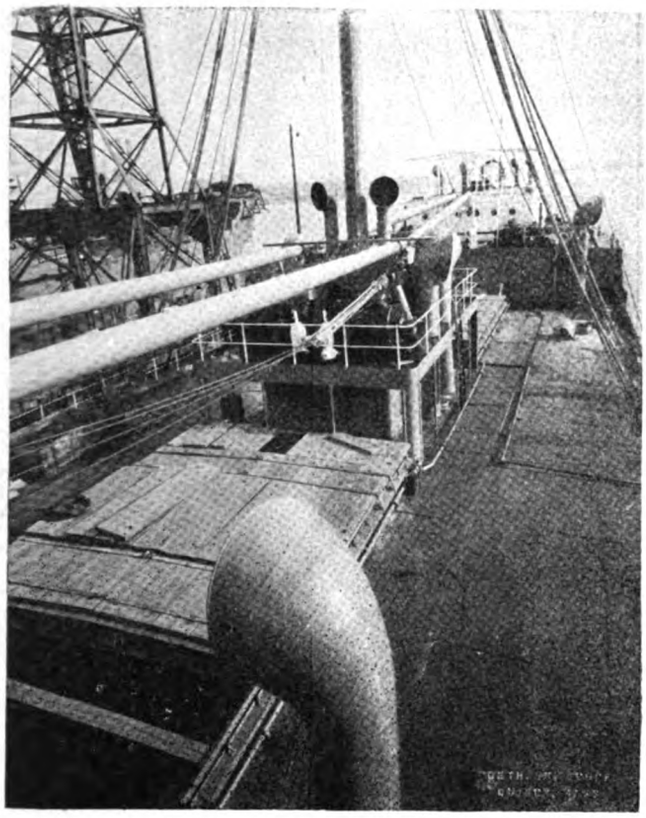
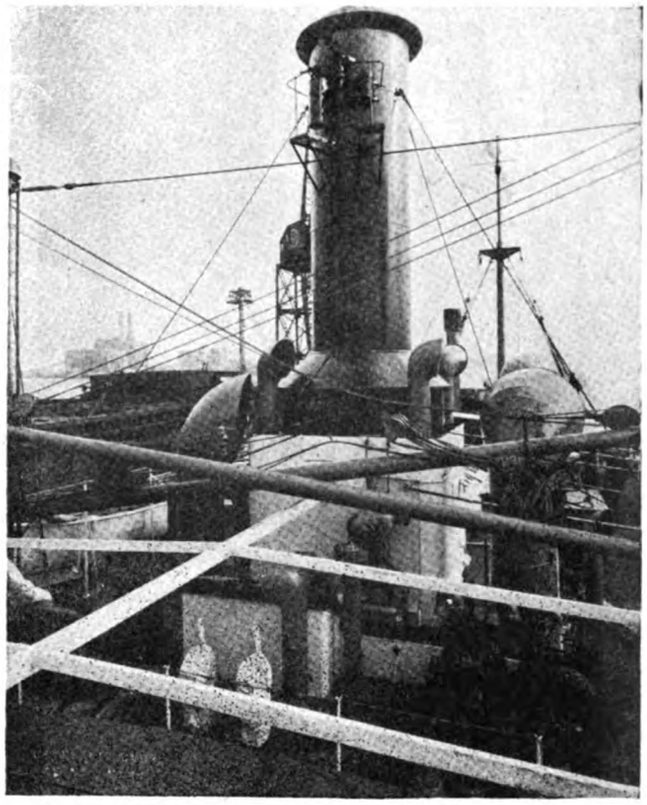
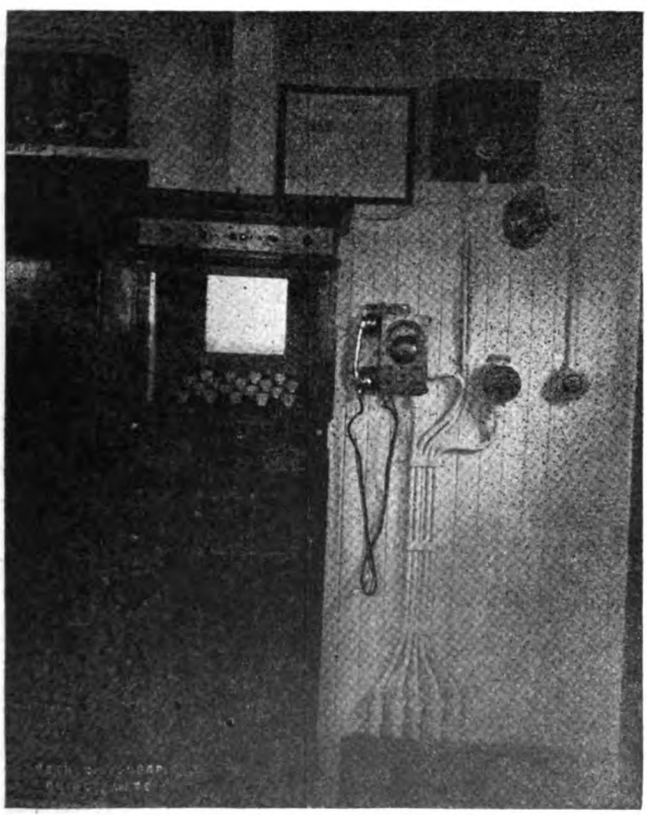


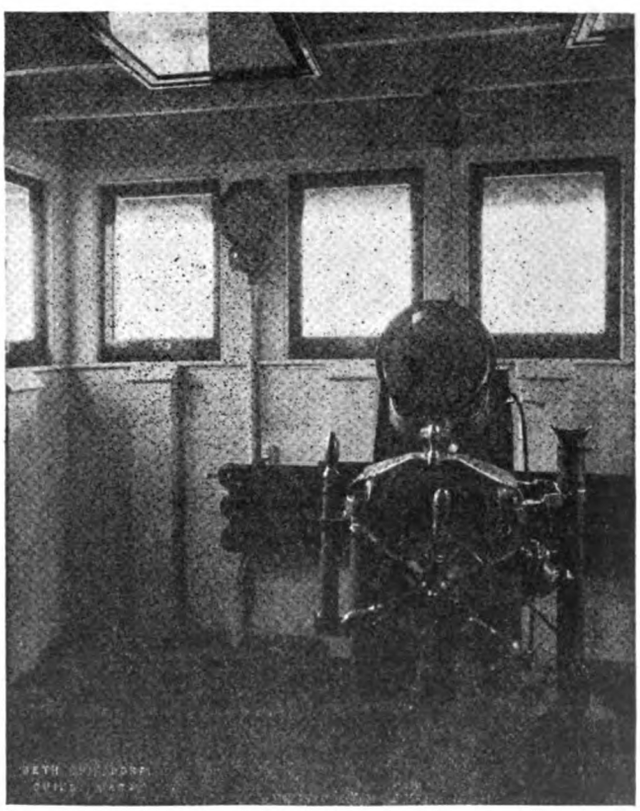
Deck view showing winch house and winch controls



Looking aft from the bridge, showing whistles on exhaust stack



Rich fire detecting cabinet in the pilot house



The Sperry gyro-pilot

and the compressors have, between them, sufficient excess air capacity to operate the main engine in case of a breakdown of the main compressors.

The emergency lighting and compressor set consists of a single acting, two cycle Mianus engine having 3 cylinders 5 5/16 inches in diameter and 7⅛ inches stroke. This

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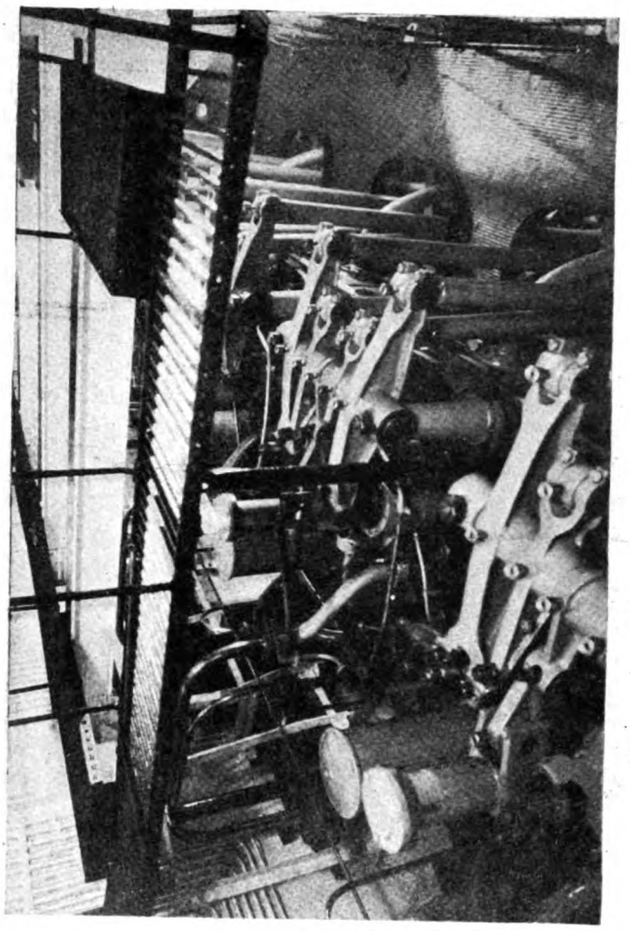
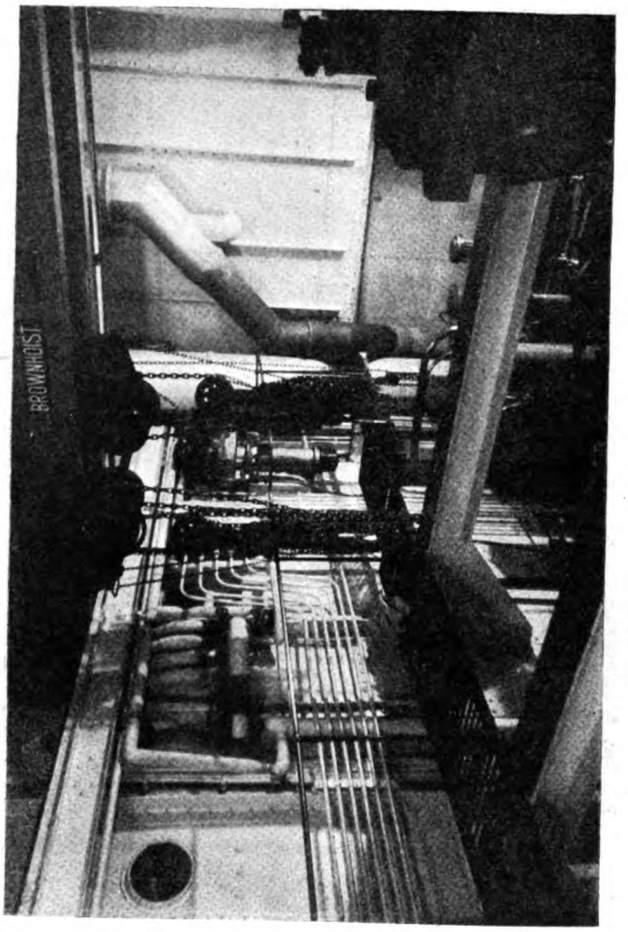
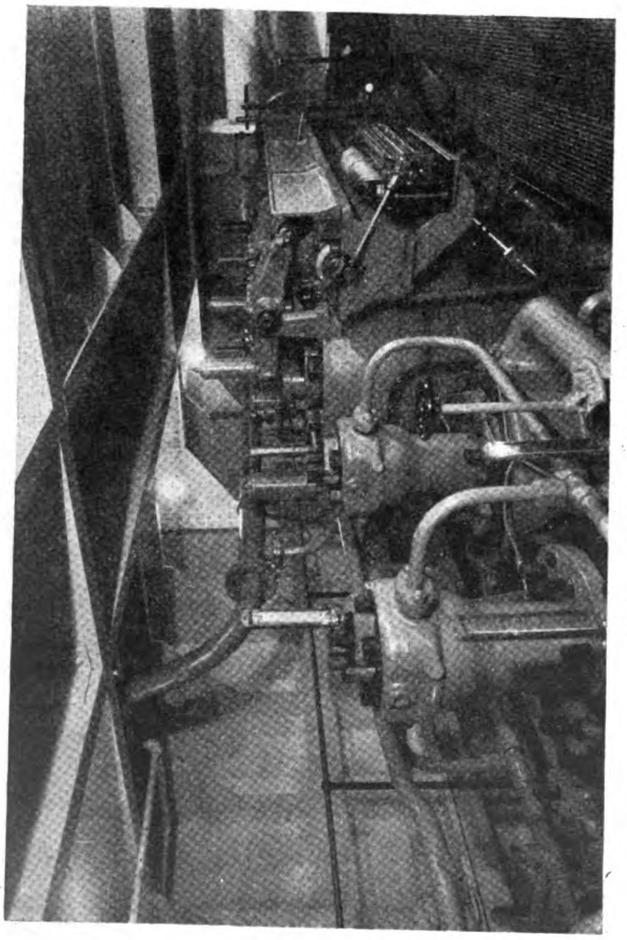


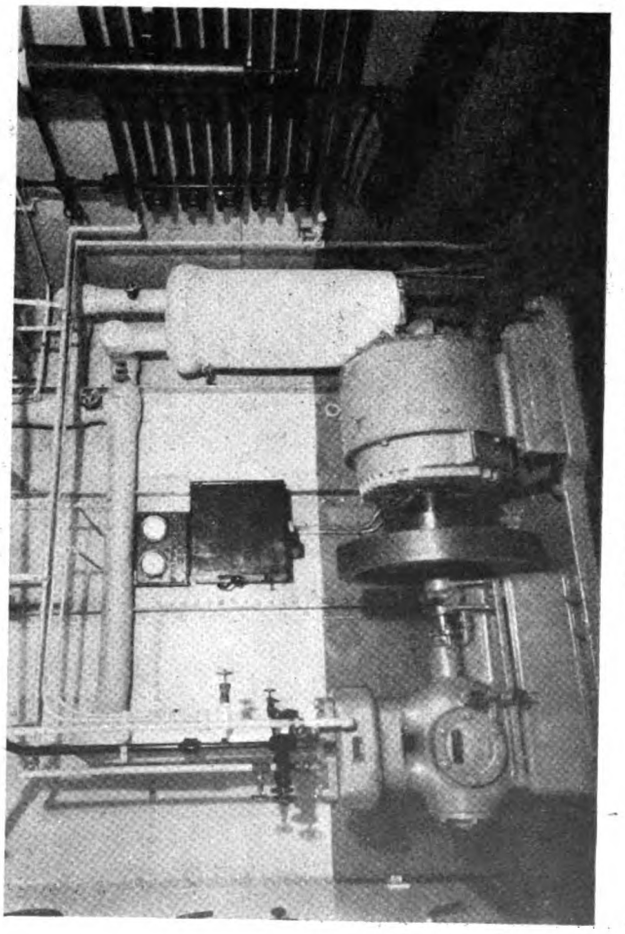
Top of the main engine



Traveling crane over the main engine



Independent compressor unit



Refrigerating machine

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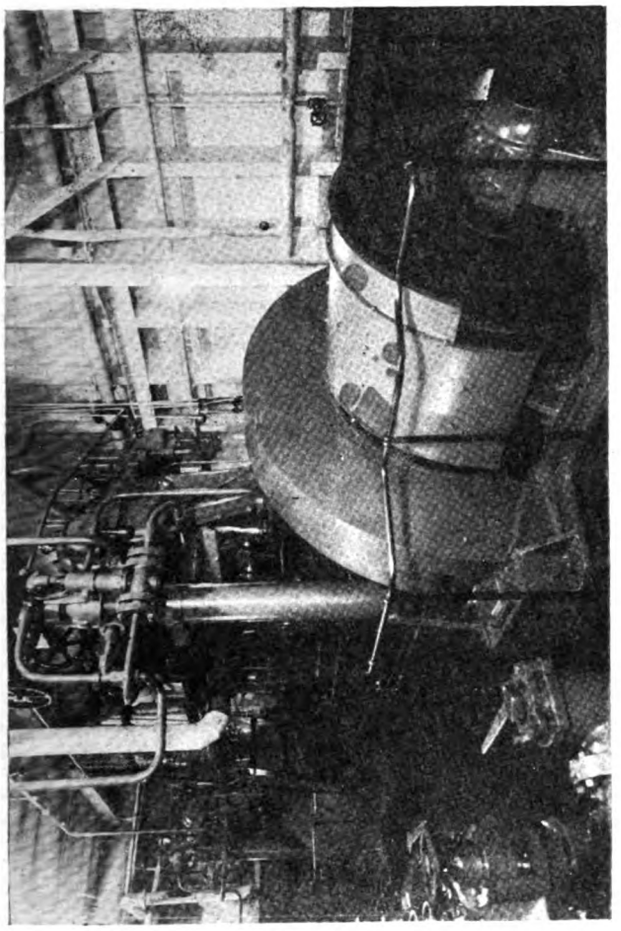
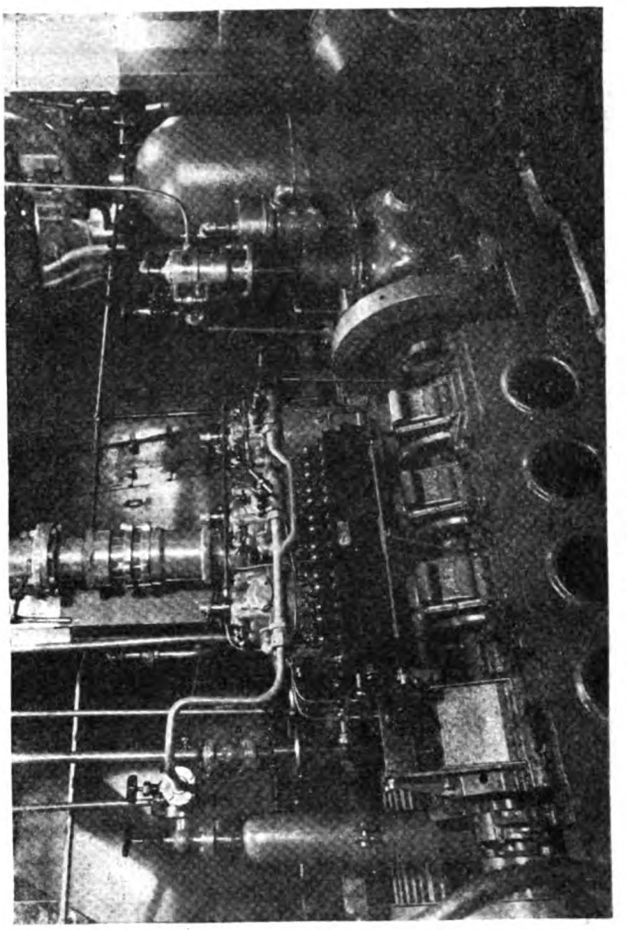
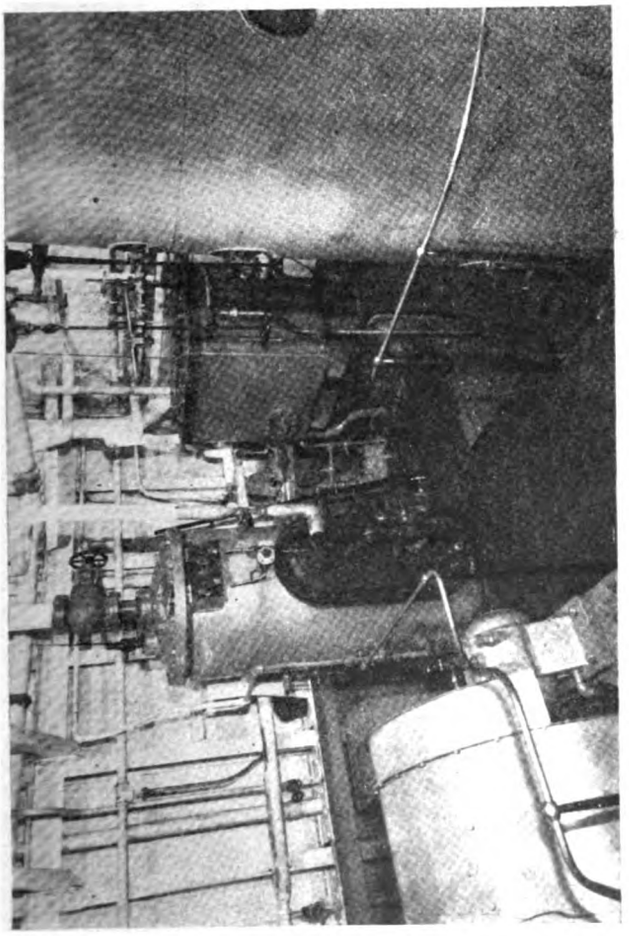


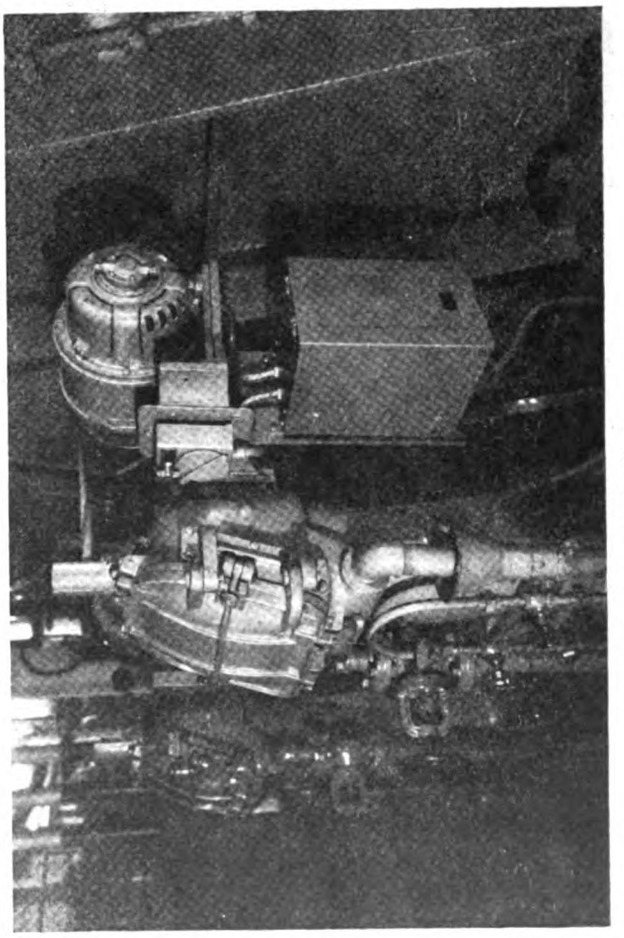
Main generating sets



Emergency lighting and compressor set



Evaporator



Sharples fuel oil separators

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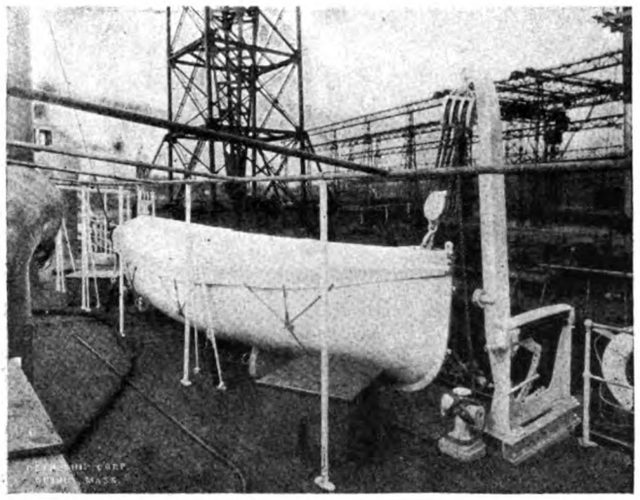
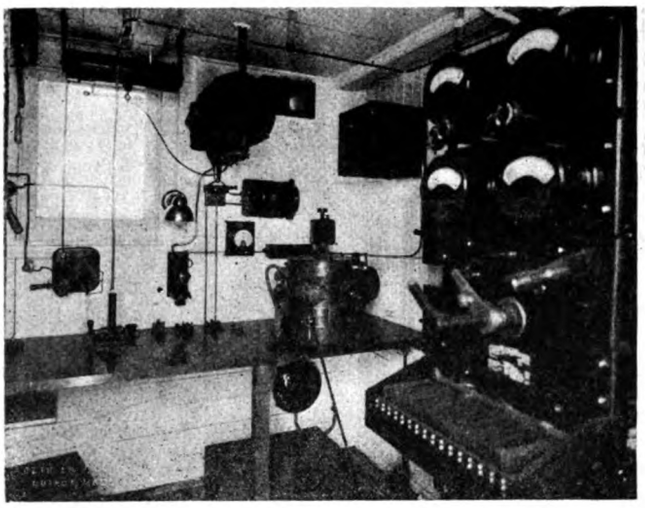
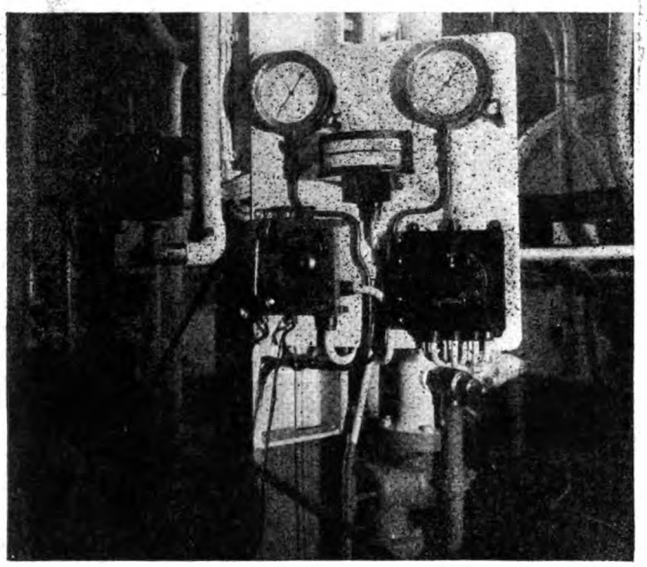


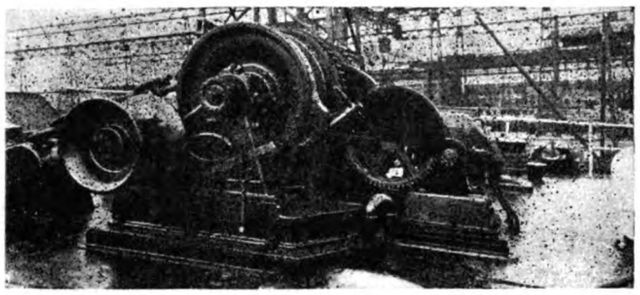
Lifeboat and Welin davits



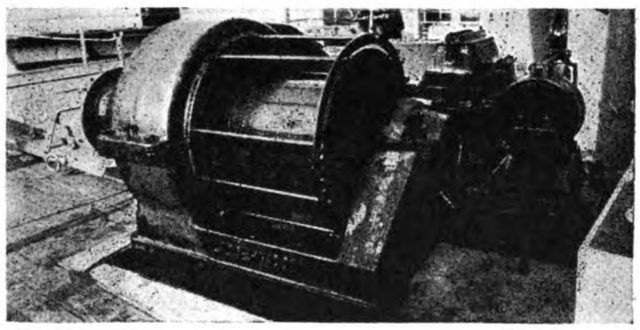
Radio room



Electric pyrometer



Electrically driven windlass



One of the Lidgerwood winches

engine has solid fuel injection and is rated at 22 brake horsepower at 550 revolutions per minute. It drives a Rix air compressor and a 14 kilowatt Diehl generator.

Among other engine room equipment, the following may be noted:

Water pumps, supplied by the Nash Engineering Company.

1 salt water centrifugal self-priming cooling pump, with a capacity of 750 gallons per minute, driven by a 30 horsepower General Electric motor.

1 centrifugal fire pump, with a capacity of 200 gallons per minute, driven by a 20 horsepower motor.

1 centrifugal self-priming engine room bilge pump, with a capacity of 300 gallons per minute, driven by a 7½ horsepower General Electric motor.

1 centrifugal self-priming fresh water (washing) pump, with a capacity of 70 gallons per minute, driven by a 7½ horsepower General Electric motor.

1 centrifugal sanitary pump, with a capacity of 70 gallons per minute, driven by a 7½ horsepower General Electric motor.

1 centrifugal fresh water (potable) pump, with a capacity of 35 gallons per minute, driven by a 1½ horsepower General Electric motor.

Oil pumps by the Kinney Manufacturing Company.

2 rotary plunger, lubricating oil pumps, with a capacity of 150 gallons per minute, driven by a 7½ horsepower General Electric motor.

1 rotary plunger, fuel oil transfer pump, with a capacity of 150 gallons per minute, driven by a 7½ horsepower General Electric motor.

A small vertical steam boiler having 175 square feet heating surface and fitted with a Sunbeam centrifugal oil burner; two pressure type Sharpless fuel oil separators and one open type lubricating oil separator, by the same makers are installed in the engine room. The fuel oil separators each have a capacity of 300 gallons per hour and the lubricating oil 150 gallons per hour.

The hull machinery and equipment includes 11 Lidgerwood winches*, a direct electric steering gear, similar to the *Tampa's,* controlled by a Sperry telemotor and a Westinghouse control panel, an electric windlass with 45 horsepower Westinghouse motor (rebuilt from the original steam windlass), and a 2-ton York ammonia refrigerating machine.

Other hull equipment includes a Lux CO_2 fire extinguish-

*See MARINE ENGINEERING AND SHIPPING AGE for July, 1926.

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ing system, supplied by the Walter Kidde Company, radio equipment by the Independent Wireless Company, a New York French Range Company's oil fired range with Ray burner and coffee urns and water heaters supplied by the Automatic Electric Heater Company.

The same completeness of equipment and careful attention to the smallest detail which were noticeable on the *Tampa* are equally characteristic of the *West Honaker* and the converted vessel, in every way, reflects the greatest credit upon the Fleet Corporation engineers who planned the work, the shipyard which carried it out and the engine builders and other contractors who supplied the machinery and equipment.

Proposals for Sale or Charter of Passenger Liners Held Up by Senate

By Harold F. Lane

WASHINTON, D. C.

CONSIDERATION by the Shipping Board of the propositions received for the purchase of the American Merchant Lines and the charter of the ships of the United States Lines has been held up by the action of the Senate on December 10 in adopting a resolution proposed by Senator Hiram W. Johnson of California, requesting the board not to consummate a sale or charter until after an investigation by the Committee on Commerce of the Senate. The resolution stated that the board was "about to sell certain ships belonging to the United States Lines and to charter the *Leviathan* and sister ships for an extended period," based on Senator Johnson's statement that he had information that the sale was likely to take place on December 13. The board had voted on November 30 to continue consideration of the proposals but at the request of members of the committee it promised not to take action until after a hearing and members of the board testified at hearings before a sub-committee of the commerce committee beginning on December 13.

E. C. Plummer, vice-chairman of the board, told the committee that no action had been taken but that the proposals were to be considered on the following day and that the board intended to comply with the desire that no action be taken until the facts had been laid before Congress. Under questioning by members of the sub-committee Mr. Plummer said that during the four months ended October 31 the United States Lines had shown a profit of $1,622,-896, due to increased passenger travel, but that for the fiscal year 1926 the two lines had been operated at a loss of $1,496,795. Commissioner Phillip S. Teller also testified on the following day, expressing the opinion that, although the management had become more efficient in the last two years, he was of the opinion that the government could not operate the lines at a profit.

W. F. Gibbs, who was associated with J. H. Winchester & Company, in the proposal to purchase the ships of the American Merchant Lines and to charter the ships of the United States Lines, testified on December 16 regarding details of the bid. He said it was made with the expectation of being able to make 6 percent on the investment but that the government could not hope to operate the ships profitably and that in order to insure profitable operation it would be necessary to have companion ships to the *Leviathan* in order to maintain a proper schedule. He took the position that it would be wrong for the government to sell its ships without making provsion for replacement.

Mr. Gibbs criticized the treatment of the various propositions received by the board, saying that he and his associates had submitted a legal bid under the terms of the board's advertisement but that the board had later given another bidder an opportunity to change his proposal to meet that of Gibbs Bros., and J. H. Winchester & Company. He expressed the opinion that it would be unwise to spend the sums that would be required properly to recondition the *America*, the *Agamemnon* and the *Mt. Vernon* because of their age, saying it would be better to devote the money to new ships.

When the hearing was adjourned to December 22 it was expected that representatives of other bidders and officials of the Fleet Corporation would be heard by the sub-committee.

* * *

TRAFFIC ON THE GREAT LAKES

The magnitude of water-borne traffic on the Great Lakes is shown in statements prepared by the Bureau of Research, United States Shipping Board, in cooperation with the Board of Engineers for Rivers and Harbors, War Department, indicating that more than 210,300,000 cargo tons of freight were handled through Great Lakes ports in 1925, an increase of 31,000,000 tons, 11.8 percent, over the total of the preceding year. Nearly 44 percent of the total water-borne commerce of the United States was conducted on the waters of the Great Lakes. The 197,500,000 tons of coastwise commerce of Great Lakes ports exceeded the total coastwise trade of ocean ports by more than 30,000,000 cargo tons, and the 12,800,000 tons of foreign commerce passing through Great Lakes ports constituted 13.8 percent of the total foreign commerce of the United States in 1925.

In the relative standing of all United States ports by volume of cargo tonnage handled, Duluth-Superior, with a total of 45,600,000 tons, ranks second to New York. Fifteen other Great Lakes ports handled more than 5,000,000 tons of freight each. The total cargo tonnage passing through these sixteen ports exceeded 172,900,000 tons and included 82.4 percent of the coastwise traffic as well as 78.3 percent of the United States foreign trade conducted on the Great Lakes in 1925.

* * *

SHIPPING BOARD ANNUAL REPORT

The government-owned merchant fleet was reduced during the fiscal year ended June 30, 1926, by a total of 350 ships, representing 1,671,390 deadweight tons, according to statements included in the tenth annual report of the Shipping Board as submitted to Congress on December 6.

This reduction was accomplished by selling ships to private interests both for operation and for scrapping purposes. With these sales, the total government-owned fleet has been reduced to 881 vessels, of 6,876,069 tons in the aggregate.

The report constitutes largely a review of its work in the establishment and maintenance of a merchant marine and its liquidation and marine development programs. Due to the fact that the Merchant Marine Planning Committee of the Board was preparing a report on the maintenance of American shipping, the board's annual report does not contain any new recommendations to Congress.

Losses sustained by the Emergency Fleet Corporation, which operates the government ships for the Shipping Board, were reduced by more than 50 percent from the fiscal year 1924 to the fiscal year 1926, the report showed. During 1924, the amount of losses was about $41,000,000; in 1925 about $30,000,000; and during 1926 less than $20,000,000.

Reduction of these losses, it is shown by the report, is an important feature of the Shipping Board's program of liquidating the great emergency wartime fleet. Part of the reduction in losses during 1926 and preceding years was the result of savings incident to the sale of ships. A much greater part of the reduction, however, is said to be directly traceable to improved operations, particularly in the cargo

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services maintained by the board. Better revenues were obtained and expenses were kept within reasonable limits, the report says, with the result that average losses on operations were materially reduced.

The greater part of the report deals with the board's permanent work. In accordance with the mandate of the Merchant Marine Act it has undertaken to form from the wartime fleet a nucleus around which an American merchant marine could be established and, ultimately, be privately-owned. Numerous trade routes, both passenger and cargo, have been established and, as fast as purchasers for these services could be developed, they have been turned into private hands for guaranteed operation over a specific period of years.

This, the report says, is but one of the major permanent activities of the board. Other activities are largely of a regulatory and promotional nature, having to do with the administration of the shipping laws as applied to the merchant marine. These activities are carried on in seven bureaus, each under the direction of one of the Shipping Board commissioners. Some of the functions of these bureaus resemble in many respects those exercised in the case of railroads by the members of the Interstate Commerce Commission.

The several ways in which the board's program is developed are summarized from the report as follows:

Through the administration of what is known as the "Construction Loan Fund," amounting at present to more than $60,000,000. Loans from this fund are made on easy terms to American citizens engaged in shipbuilding enterprises.

Through bestowal of generous compensation for the carriage of United States mails. These contracts, worked out in conjunction with the Post Office Department, form one of the most effective aids to the merchant marine.

Through the study of ports and port facilities, territorial regions tributary to ocean terminals, comparative costs of foreign and domestic ship construction and operation, marine insurance, and other problems relating to trade routes and commercial shipping.

Through experimental work in the field of internal combustion engines and the Dieselization of many vessels of the government fleet.

Through codification of navigation and shipping laws.

Through Americanization of crews and study of personnel and labor conditions under the "Sea Service" Division.

Among the more important items sold during the fiscal year were four complete cargo and two complete passenger lines, these six services being disposed of in their entirety. One of the cargo lines, The American Palmetto Line, was subsequently taken back by the board in order that service might not lapse, some question having arisen as to whether operations would be continued under private ownership.

The sale of the two passenger lines, the Pan American Line and the American Oriental Mail Line, completes the disposal of all passenger services established and operated by the board, with the exception of the United States Lines, operating from New York to the United Kingdom and Europe, and the combination cargo and passenger service of the American Merchant Line from New York to London.

Due in large measure to the southern industrial development, about 40 steamers of the type built on the Great Lakes during the war, were sold for use in coastwise trade. Nor was the unusual demand for coastal and inter-coastal vessels confined to the comparatively small lake-built type. Fifteen ships of the 5,000-ton class, and twenty ranging in size from 7,500 to 12,000 tons each, were also sold for service in domestic waters.

Among the 350 ships disposed of were 199 (totaling 813,820 deadweight tons), all practically without market value as commerce carriers, sold to the Ford Motor Company for scrapping purposes.

APPROPRIATIONS FOR SHIPPING BOARD

An appropriation of $12,290,000 for the Shipping Board and the Emergency Fleet Corporation for the fiscal year 1928 is recommended by the Budget Bureau in the estimates submitted to Congress on December 7 by the President. This is a reduction of $1,908,574 as compared with the appropriation for 1927, omitting the $10,000,000 special appropriation. To enable the Fleet Corporation to operate ships or lines of ships which have been or may be taken back from the purchasers by reason of competition or other methods employed by foreign shipowners or operators, $10,000,000 was included in the $24,198,574 appropriated for 1927. The estimate for the fiscal year 1928 provides that the unexpended balance of this appropriation of $10,000,000 shall be made available until June 30, 1928. The estimate of $12,290,000 for 1928; the use of the unobligated balance of the cash reserves pertaining to operating funds (and on hand as at July 1, 1926); such amounts as may be collected of the accounts pertaining to operating funds as may be receivable as at July 1, 1927; such an amount, if any, as may be necessary, of the unexpended balance of the $10,000,000 available for the operation of ships, if any, which have been or may be taken back from the purchasers; and such savings, if any, in operating expenses as may result from the sale of active ships, as opportunity offers, is considered sufficient to meet the estimated operating deficit for 1928.

In his comment on this estimate in the Budget message the President said:

"There is included in this Budget $12,000,000 for the operating deficit of the Shipping Board. It is believed this amount, reenforced by certain receivables and other available resources, with reduction of losses through sales of lines as opportunity offers, as contemplated by the Congress, will permit necessary operation of the government's merchant marine during the fiscal year 1928. From 1921 to 1926, inclusive, the total net loss incurred in the operation of its various lines was $238,157,582.18. These figures represent losses sustained through the operation of the active fleet and the maintenance of inactive vessels. I mention this to show that in the six fiscal years from 1921 to 1926, inclusive, the government has spent in the operation of its merchant marine an average of nearly $40,000,000 a year. The losses have been gradually diminishing each year. Provision is also made for continuing the availability of the $10,000,000 defense fund appropriated in the first session of this Congress.

"With regard to the operation of vessels by the Shipping Board the merchant marine act of 1920 contemplates that such operation shall be maintained unless it shall appear within a reasonable time that the lines or parts thereof can not be made self-sustaining. None of the lines now being operated are self-sustaining, and while the reduction in cost has been helpful from the standpoint of the Treasury there is no immediate prospect that any part of these lines can be operated without loss to the government.

"Under the joint resolution of July 3, 1926, the United States Shipping Board will present to the Congress not later than January 1, 1927, two plans for building up and maintaining an adequate merchant marine for commerce and national security—one through private capital and under private ownership and the other through construction, operation, and ownership by the government. The time is approaching, if it has not already been reached, when the Congress should give consideration to the formulation of a more definite policy regarding our merchant marine. Such definite policy, I trust, is foreshadowed in the resolution to which I have referred."

* * *

APPROPRIATIONS FOR NAVY DEPARTMENT

The Budget Bureau estimate for the appropriations for the Navy Department for the fiscal year 1928 is $317,815,500, including $4,000,000 to be made available by transfer from the naval supply account fund. This is a decrease of $9,246,475 as compared with the amounts available for 1927.

The Budget estimates are predicated upon a slight reduction in the number of ships to be operated, involving the decommissioning or placing in reserve of certain old ships, and the commissioning of the two new airplane

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carriers; for carrying forward the construction of ships under way at the end of the fiscal year 1927; for continuing the work of modernization of the six old coal-burning battleships; for meeting the second increment of the Navy five-year aircraft program.

The net decrease of $9,246,475, mentioning the principal items of importance, involves increases for Naval Reserve from $3,820,860 to $3,850,000 (also $235,000 for new planes for the reserve is carried under aviation); for ordnance and ordnance stores from $10,625,000 to $11,450,000; for purchase and manufacture of smokeless powder from $772,000 to $1,000,000; for pay of the Navy from $119,863,500 to $124,300,000 (including a new item for outfits on first enlistment involving $2,300,000); for provisions, Navy, from $19,207,000 to $19,430,000; for aviation from $19,065,288 to $19,790,000 (plus $900,000 increase in contract authorization—$5,000,000 for 1928 as against $4,100,000 for 1927—also includes $235,000 for purchase of planes for the Naval Reserve); for pay, Marine Corps, from $14,970,347 to $15,031,900; and reductions for transportation and recruiting, Bureau of Navigation, from $4,664,000 to $4,500,000; for engineering from $19,150,000 to $18,800,000; for construction and repair of vessels from $16,950,000 to $16,600,000; for maintenance, Bureau of Supplies and Accounts, from $9,500,000 to $9,400,000; for fuel and transportation from $13,950,000 to $12,000,000; for maintenance, Bureau of Yards and Docks, from $7,000,000 to $6,900,000; for public works from $2,735,300 to $1,867,500; for general expenses, Marine Corps, from $8,090,000 to $7,939,000; for major alterations of vessels from $7,500,000 to $2,210,000; for increase of the Navy from $33,275,000 ($28,275,000 direct appropriation and $5,000,000 transferred from the naval supply account fund) to $27,250,000 ($23,250,000 direct appropriation and $4,000,000 to be transferred from the naval supply account fund).

In his Budget message the President said that no provision had been made for commencing the construction of the remaining three of the eight light cruisers which the act of December 18, 1924, authorizes to be undertaken prior to July 1, 1927, because the country is now engaged in negotiations to broaden our existing treaties with the great powers which deal with the elimination of competition in naval armaments and he felt that "it would be unfortunate at this time and not in keeping with our attitude toward these negotiations to commence the construction of these three cruisers. Rather do I commend to the Congress," he said, "the enactment of legislation which will extend the time for beginning their construction."

The proposal to postpone construction of the three scout cruisers aroused considerable criticism in Congress and on December 18 Chairman Butler of the House committee on naval affairs introduced a bill, following a conference with the President, authorizing the President to undertake the construction of 10 scout cruisers, costing, exclusive of armor and armament, not to exceed $10,500,000 each. The bill as introduced was merely an authorization, without carrying an appropriation, but when the committee on naval affairs ordered a favorable report on it on December 20 Representative Britten stated that this had been voted with an understanding that the committee would favor an appropriation for the completion of the three cruisers already authorized.

* * *

MANAGING OPERATOR AGREEMENTS TO BE REVISED

A revision of existing arrangements between managing operators of Shipping Board vessels and the Emergency Fleet Corporation to make the income of the operators dependent upon the success with which they handle the lines under their control, was approved by the Shipping Board at a meeting on December 14. This change is designed to stimulate activity on the part of operators.

The new plan is one by which a minimum commission will be paid the operators on the basis of operations which result in maximum losses, the maximum losses to be determined on the basis of past experience of the lines. As the operators succeed in reducing their losses the rate of percentage of the commissions received will be advanced. Advances in percentages will be made for each 10 percent reduction of the fixed maximum operating loss per round trip voyage.

Due to local conditions on the different trade routes maintained by the Shipping Board the amount of the fixed maximum losses will necessarily differ. The Fleet Corporation president will, therefore, prepare a statement indicating the maximum expected loss for each of the lines and submit it to the board as a basis for new contracts to be entered into on the sliding scale of compensation plan.

* * *

O'CONNOR SAYS PEOPLE WANT MERCHANT MARINE

The following statement with respect to views expressed at the regional hearings held by the Shipping Board during the past six weeks, and concluded with two hearings held at Washington on November 22 and 23, was made by Chairman T. V. O'Connor:

"The hearings held by the Shipping Board in the large cities of the United States for the purpose of ascertaining the public's attitude toward the future of American shipping have demonstrated that there is an active demand for the carrying out of the Merchant Marine Act calling for the establishment of an American merchant marine on a permanent basis. The attitude of most of the shippers, bankers, farmers, exporters, importers and others who appeared before the board is that we should have a merchant marine, privately owned if possible, but a merchant marine anyway.

"The hearings themselves were a revelation of the interest the American people, both on the coast and in the interior, are showing in American maritime affairs. Never before in my recollection has there been a more unified feeling that ships to fly the American flag are absolutely necessary to the progress of our commerce the protection of our farmers, and the general welfare of our nation. It is clear that the public is becoming what they call 'ship minded' and that it means to have a merchant marine for this country.

"We have stated a number of times that the prices offered for the government's vessels are not necessarily a consideration. Also we have stated that we have sold about 1,100 ships, that we still have over a thousand for sale and at present there are no more customers. A great proportion of the ships sold have gone into the protected coastwise and intercoastal trades, and only the most profitable have gone into the foreign trade. We have tried to sell the rest of our ships, but we have found that there is no one to buy them on a basis which will protect the government's interests. It has, therefore, come down to the question of whether the government will continue to operate the ships in the foreign trade during the development period or take the American flag from the seas. I think there is little question but that this latter must not be allowed to happen. It cannot be said at this time just what the nature of the board's recommendations to Congress will be."

At the suggestion of Senator Jones the Senate on December 20 adopted a resolution extending to January 12 the time for the filing of the report of the Shipping Board on merchant marine policy called for by Senate Resolution No. 262. Senator Jones said the board was working on the report but needed a little additional time in which to complete it.

H. E. BRELSFORD, head of the technical division, department of maintenance and repair, U. S. Shipping Board Emergency Fleet Corporation, 45 Broadway, New York, has resigned, effective January 1 to become assistant general manager of the Snow Works of the Worthington Pump & Machinery Corporation at Buffalo, N. Y.

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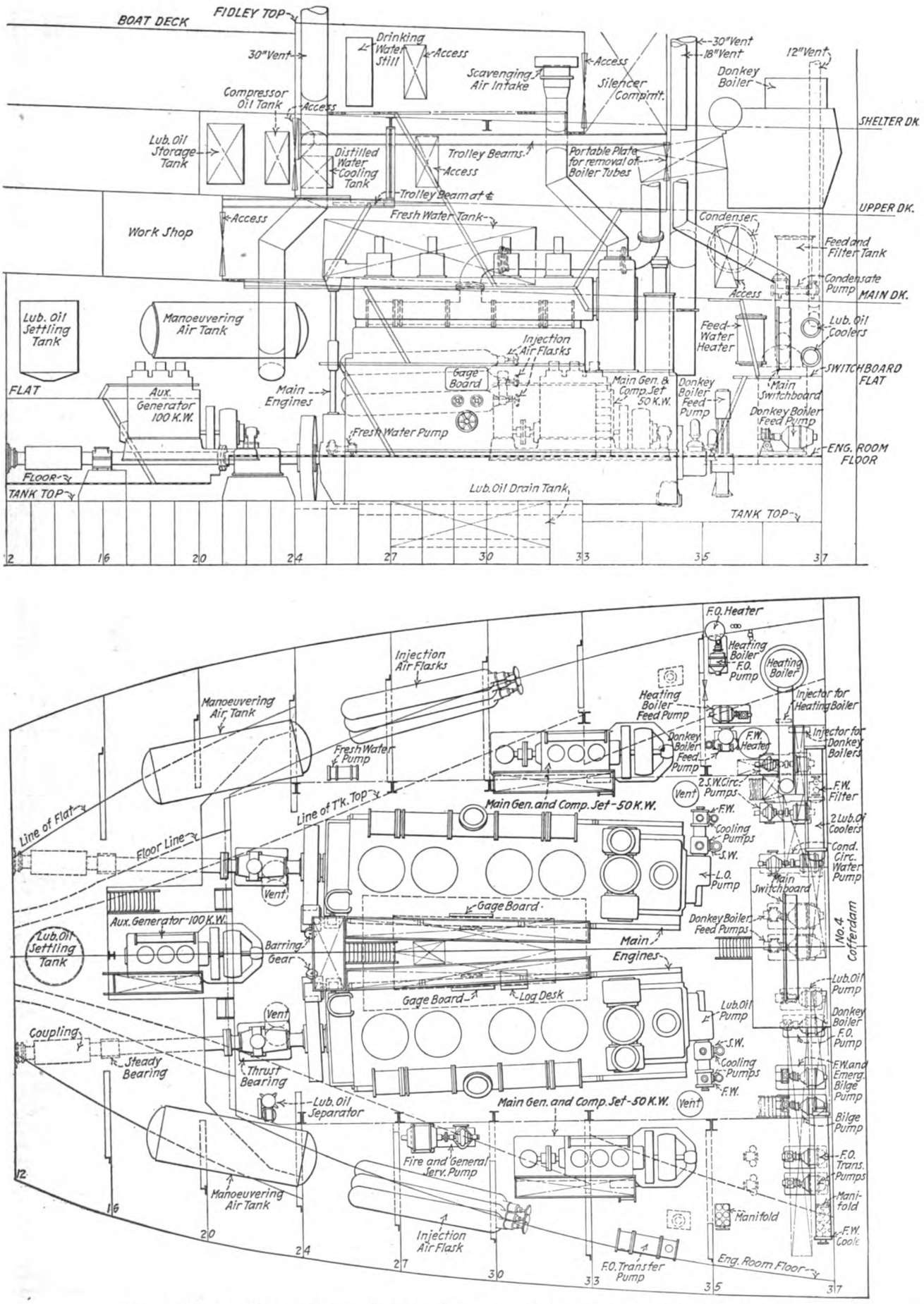

Longitudinal section and plan of the engine room of the motor tanker E. T. Bedford

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The Re-Engining of the Tanker E. T. Bedford

Busch-Sulzer Diesel engines replace steam machinery in Standard Oil tankers—Work carried out at Federal yard

THE tank steamer *E. T. Bedford,* a vessel of 9,563 gross tons, which was built in 1921 for the Standard Oil Company of New Jersey by the Federal Shipbuilding and Dry Dock Company, was turned over to her owners on December 1 after having been refitted with Diesel engines by the original builders.

The *Bedford,* which is a twin screw ship approximately 500 feet in length, was originally fitted with two 3 cylinder triple expansion engines having cylinders 20½ inches, 35 inches and 60 inches in diameter by 42 inches stroke, steam at 210 pounds working pressure being supplied by 3 single end Scotch boilers.

This steam machinery has now been removed and two single acting, two cycle Diesel engines, built by the Busch-Sulzer Bros.-Diesel Engine Company of St. Louis, installed in its place. The new engines were described in MARINE ENGINEERING AND SHIPPING AGE for January, 1926, but a restatement of the main dimensions and some additional particulars are in order.

Each engine has four cylinders 30 inches in diameter and 42 inches stroke, the designed brake horsepower being 1,500 at 90 revolutions per minute. As the mean effective pressure and piston speed assumed for the design are both low, it is certain that 1,800 brake horsepower can be developed without difficulty.

The massive construction of the engine is indicated by the crank case which is of the box frame enclosed type with girder construction giving the required strength without the use of bolts. There are 4 crosshead guides per cylinder with equal ahead and backing areas.

The bed plate has a double row of holding down bolts, The crank shaft is solid forged in 3 sections, the two main sections being interchangeable and the forward section arranged for driving the scavenging pump and compressor.

The air compressor is of the 3 stage type and of sufficient capacity to handle both engines.

The cylinder heads are of a simple symmetrical construction designed with a view of easily withstanding the expansion stresses due to high temperature. The pistons are water cooled through telescopic tubes with long overlaps to prevent leakage into the crank case.

The fuel pumps are of the constant stroke type with controlled seating of the suction valves to regulate the engine speed.

As the engine is self-contained not only as regards scavenging pump and oversize air compressor, but also lubricating oil pumps and fresh and salt water cooling pumps, the fuel consumption of 0.425 pound per brake horsepower obtained on test is unusually low.

The engines of the *Bedford* have been guaranteed for operation on heavy fuel oils and to this end heaters have been installed to keep the oil in a free flowing condition right up to the fuel valves.

The following auxiliaries are installed:

Two Babcock & Wilcox watertube donkey boilers with 1,591 square feet of heating surface each.
One Federal, vertical, heating boiler with 269 square feet of heating surface.
One Griscom-Russell, Reilly No. 22, feedwater heater with a maximum capacity of 62,460 pounds per hour.
Three Bethlehem, coil, fuel oil heaters with a capacity of 4,575 pounds per hour each.
One Federal surface condenser with 2,000 square feet cooling surface.
Two Griscom-Russell straight tube lubricating oil coolers with a capacity of 75 gallons per minute each.
Two Griscom-Russell straight tube fresh water oil coolers with a capacity of 65 gallons per minute each.
Two Worthington centrifugal salt water circulating pumps with a capacity of 500 gallons per minute at 30 pounds pressure.
One Worthington centrifugal fire and general service pump with a capacity of 200 gallons per minute at 125 pounds pressure.
One Worthington centrifugal condenser circulating pump with a capacity of 1,000 gallons per minute.
Two Northern rotary bilge pumps with a capacity of 275 gallons per minute.
Two Northern rotary fuel oil transfer pumps with a capacity of 50 gallons per minute.
One Northern rotary lubricating oil pump with a capacity of 125 gallons per minute.
One Northern rotary donkey feed pump with a capacity of 100 gallons per minute.
One Northern rotary donkey fuel oil pump with a capacity of 50 gallons per minute.
One Northern rotary heating boiler fuel oil pump with a capacity of 25 gallons per minute.
One Northern rotary heating boiler feed pump with a capacity of 30 gallons per minute.

The pumps listed above are all motor driven. In addition there are a number of steam pumps, including the cargo oil pumps, which were originally on the ship and which have been retained.

Further engine room equipment is as follows:

Two 50-kilowatt auxiliary generator-compressor sets, each driven by a 150 horsepower Nelseco Diesel engine.
One 10-kilowatt auxiliary generator set driven by a 150 brake horsepower Nelseco engine.
One 20-kilowatt emergency steam-driven General Electric generator set.
One Worthington emergency air compressor, motor driven.
Maxim silencers are fitted to the main and auxiliary engine exhausts and 3 De Laval oil purifiers are installed, one for lubricating and 2 for fuel oil.

The hull equipment includes a hydro-electric steering gear by the Hyde Windlass Company, a 2-ton Brunswick ice machine, a Lux fire extinguishing system and Pneumercator tank indicators.

New Radio Invention to Prevent Collisions Between Vessels in Fog

COLLISIONS between ships passing in a storm or fog will be avoided in the future by the use of a new radio invention. This announcement is made by the Federal Telegraph Company of California, following exhaustive tests along the Pacific coast by the United States Lighthouse Service, the Standard Oil Company and the Federal Telegraph Company.

The new device, which has proved satisfactorily that it will remove the danger hovering over vessels at times of low visibility, causing loss of life and valuable shipping, has been named the Kolster mobile radio beacon in honor of its inventor, Dr. F. A. Kolster, who also invented the radio compass. It is described as a low power automatic radio transmitter which sends out a characteristic signal over a short distance.

Installed in the pilot house, independent of the ship's radio telegraph, it is "turned on" in thick weather. The radio signal it transmits is heard by any ship within 10 miles, which by the use of the radio compass, or direction finder, can determine the position of the approaching vessel.

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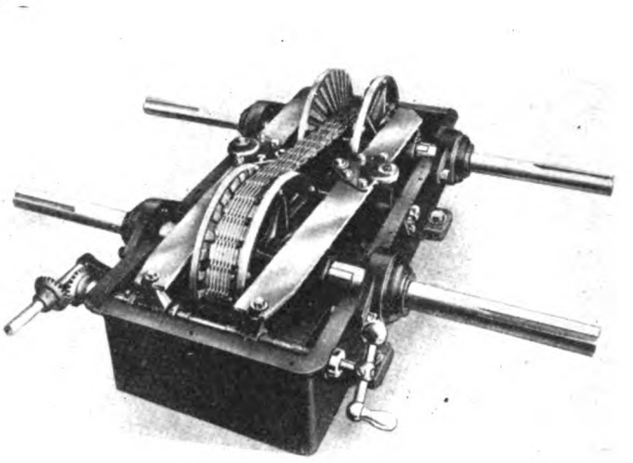
The official tests were made by Captain Rhoades, superintendent of lighthouses, on board the lighthouse tender *Sequoia;* by Dr. Kolster, who was formerly chief of the radio division of the Bureau of Standards, and by the Standard Oil tanker *J. C. Fitzsimmons,* between San Francisco Bay and San Pedro harbor. Reception of the instrument's automatic signal was declared as satisfactory for tracing a ship's course as seeing the craft's lights on a clear night.

The mobile beacon is about as large as a radio receiving set placed on a living room table, and will be inexpensive. It can be placed anywhere in a pilot house and does not require an experienced operator. The equipping of ships with the beacon will begin in a few months.

Positive Drive Infinitely Variable Gear

A Remarkable Invention of Great Importance in Marine Engineering

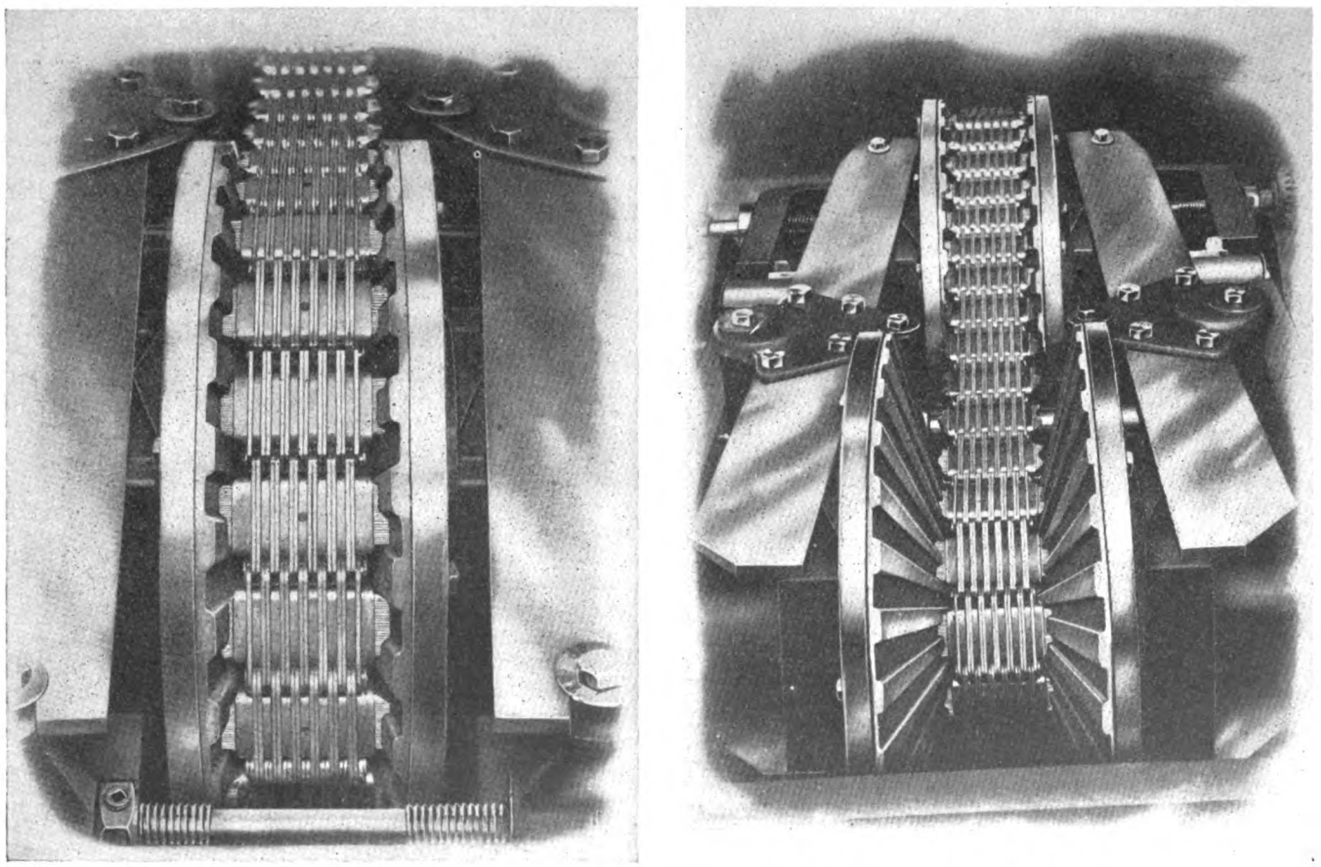
THERE has just appeared on the market an invention in the field of the mechanical transmission of power which is of particular interest to marine engineers, rendering possible accurate speed control in all kinds of machinery. This is the "P. I. V." (positive infinitely variable) gear which, by the simple operation of a lever or handle, allows an infinite number of speed variations to be given, with positive (non-slipping) transmission, to a driven shaft, while the latter may also be varied as required. In marine work for example such a gear is of great value in connection with hoisting, loading, and general conveying plant, capstans and steering of ships. By its use the alternating current motor can be made available for direct variable speed driving, itself a revolution in the field of power.



General view of the positive drive infinitely variable gear

The new gear, which has been patented in over 40 different countries, is being handled by Messrs. Close Bros., Ltd., Basildon House, 7 Moorgate, London, E.C.2., England. It is soon to be manufactured in the United States.

As showing the remarkable possibilities of the invention it can operate either at long centers with an open chain drive or in the form of a small totally enclosed gear box, while a modification can be supplied that allows of constant variation in the driven shaft within any pre-determined range. In one example a constant speed driving shaft runs at 300 revolutions per minute, while the variable speed driven shaft starts at 330 revolutions per minute and gradually reduces in speed, infinitely and positively, to 270 revolutions during a period of 50 minutes. After this the



Illustrations showing the maximum and minimum effective diameters of the gears

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variable shaft returns to 330 revolutions during 4 seconds and the cycle re-commences automatically, while the conditions can be altered as required.

The value of the advance made can best be realized by considering the ordinary gear box as used on a motor car which in spite of the cost, trouble and loss of efficiency only allows of a few definite speeds, generally not more than 3 or 4.

The "P. I. V." gear consists essentially of two expanding pulleys of the opposed conical disk type, one on each shaft, connected by a chain at any desired centers, so arranged that the two halves of each pulley can be moved along the shafts slightly to adjust the exact space between them. The inner surface of the two halves of the pulleys slope inward to the shaft at an angle of 30 degrees and has a series of ribs with equivalent channels or recesses broader at the top or periphery and converging to the hub. The driving chain is of unique construction, consisting of short links built up so as to contain a longitudinal open sleeve or casing having inside a number of loose small thin steel plates or slats pressed together which project at each side from the link cases, and are capable of any desired independent motion transversely to the line of travel of the drive. As a link enters the "V" between the pulleys, the ribs or teeth on one pulley face push the necessary number of slats across into the spaces between the ribs on the opposite pulley face, this action being carried out easily because the flanks of the radial teeth are also inclined at an angle. The design is such that the rib of one pulley is always opposite a channel or space in the other. In this way the drive is truly positive, that is without any possibility of slip, the ribs on the inner faces of the split pulleys acting as compound teeth which engage the chain at the edges.

In order to alter the speed ratio between the two shafts, it is only necessary to adjust the distances very slightly between each pair of split pulleys, using a common handle or lever. When the two halves of the driving unit come close together the chain rises in the grooves, giving the effect of a pulley of great diameter, while the driven pulley on being opened causes the chain to sink correspondingly deeper down in the grooves towards the hub, equivalent to a smaller diameter pulley. In the same way the reverse action takes place. The whole gear, as already indicated, may be contained in a small box partially filled with oil, which is waterproof and impervious to dust and other deleterious influences, or used as an open drive at any center distance.

As an example, the 5 horsepower "P. I. V." gear, the smallest standard size, has a driving shaft running at 750 revolutions per minute and allows an infinity of speed to the driven shaft between the range of 300 and 1,800 revolutions per minute merely by the operation of a single handle, the dimensions of the gear box being 20½ inches by 13½ inches by 10 inches.

Tests of this gear, recently carried out in the National Physical Laboratory, show a transmission efficiency of from 87 to 95 percent over the extreme range of speed variation and the ability to carry ample overload with a very slight and quite negligible temperature rise.

AMERICA'S FOREIGN TRADE GROWS.—American foreign trade made notable advances in 1926. Our proportion of the world's exports was higher during the year, both in volume and value, than ever before. We exported more products to a wider range of markets and we imported more products from a wider range of sources of supply. These factors of expansion denote a healthy state of trade and confirm the assurance that the United States will maintain its position as the world's leading exporting nation.—*O. K. Davis, secretary, National Foreign Trade Council.*

Bonn's Patent Tube Bending Machine

IT has long been evident that if tubes could be bent cold by purely mechanical methods and without filling them great economies and a superior product could be obtained. Many excellent machines have been evolved but their application has been restricted owing to the multiplicity of the parts peculiar to the bends required and also of the sizes of tubes to be dealt with.

In order to extend the use of tube bending machinery it is necessary to eliminate, as far as possible, these formers and their complimentary parts, if any. It is further desirable to satisfy the following conditions:

(1) That any bend between a maximum and a minimum can be made in any of the tubes the machine can bend.
(2) That the machine is open so that coils can be produced.
(3) That those parts particular to any given diameter of tube shall be few, light and easily and quickly changed.
(4) That all adjustments are so arranged as to promote the greatest ease and rapidity of working, and
(5) That the machine can be worked by one man.

Bending a tube round a former is the obvious way but it is not the correct way because a tube, owing to its section, is strong to resist bending while weak to resist collapse due to

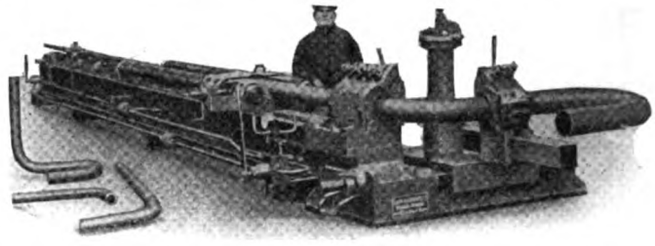

Fig. 1.—The Bonn tube bending machine in operation

locally imposed loads. Owing to these characteristics a tube must not have the local loads, which must be applied to it in order to produce the necessary bending moment, applied where the tube is bending and difficult or impossible to confine but in grips or guides which totally confine straight portions of the tube in a way which makes distortion or collapse practically impossible at the points of application. It is also necessary that the bending moment shall be a maximum in one region where bending is to take place and that the amount of bending per unit length shall be constant in order that the bend shall have a constant radius.

If a machine is so designed and constructed that the part of the tube which forms the beginning of the bend is firmly held in a grip which is carried on a spindle free to revolve and is constrained and guided to move in a straight line up to or about the point at which bending commences, then it will, when pushed forward from behind, follow the grip round the spindle and form a bend. In such a machine the local forces applied to the tube to give the required bending moment are applied in the grip and the guide where no distortion is possible and the bending takes place in a region where no local forces are applied.

The force pushing the tube multiplied by the normal distance of its center line from the center line of the spindle will equal the strength of the material multiplied by its modulus of section and the point of maximum positive bending moment will lie at the point where the normal cuts the center line hence the tube will bend in this region and here only and the amount of bending per unit length will be constant.

Bonn's patent tube bending machine is claimed to embody the principles of bending as laid down and to satisfy all the conditions aforementioned which must be fulfilled by an ideal tube bending machine.

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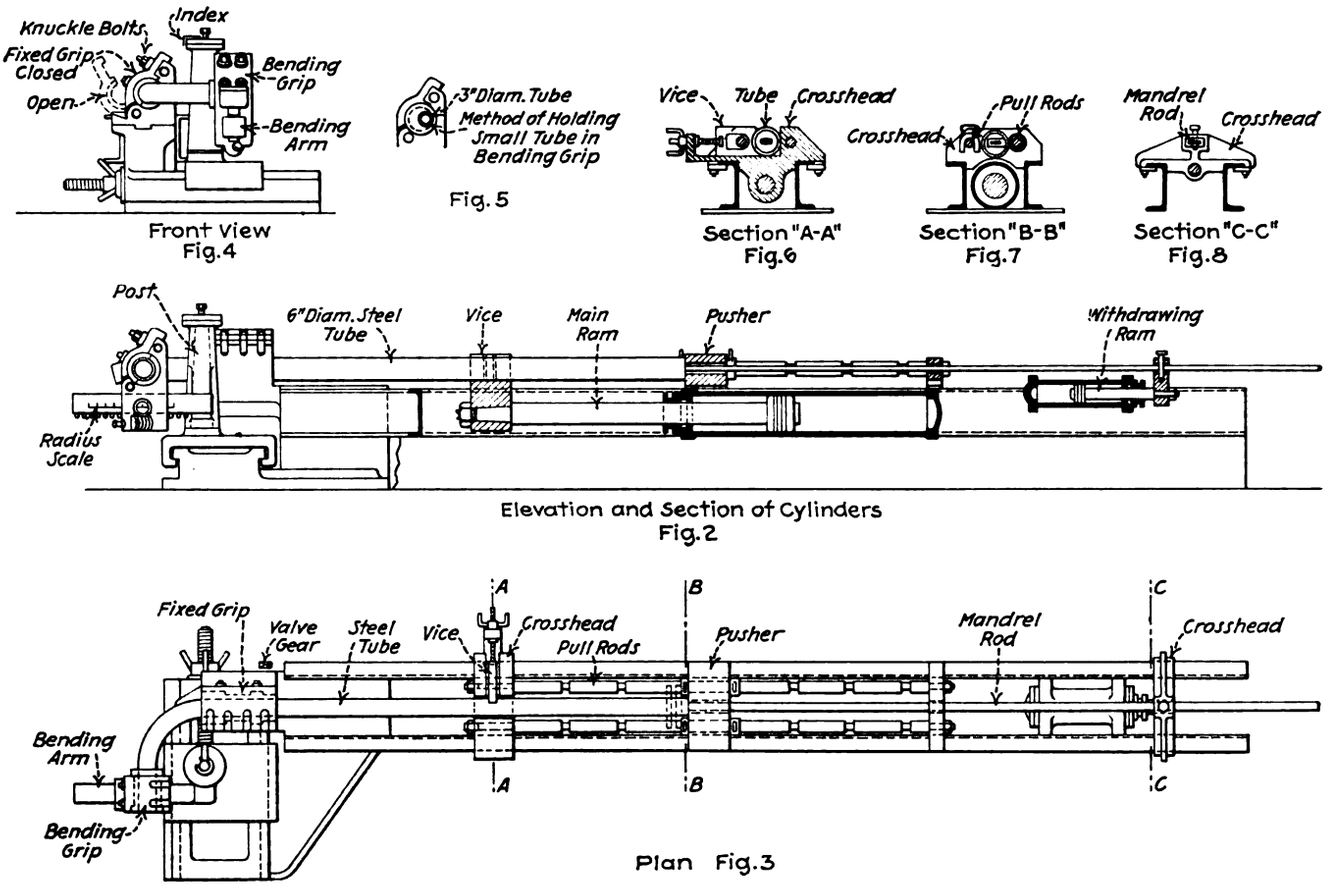


Figs. 2-8.—Assembly drawing and sections of Bonn hydraulic tube bending machine

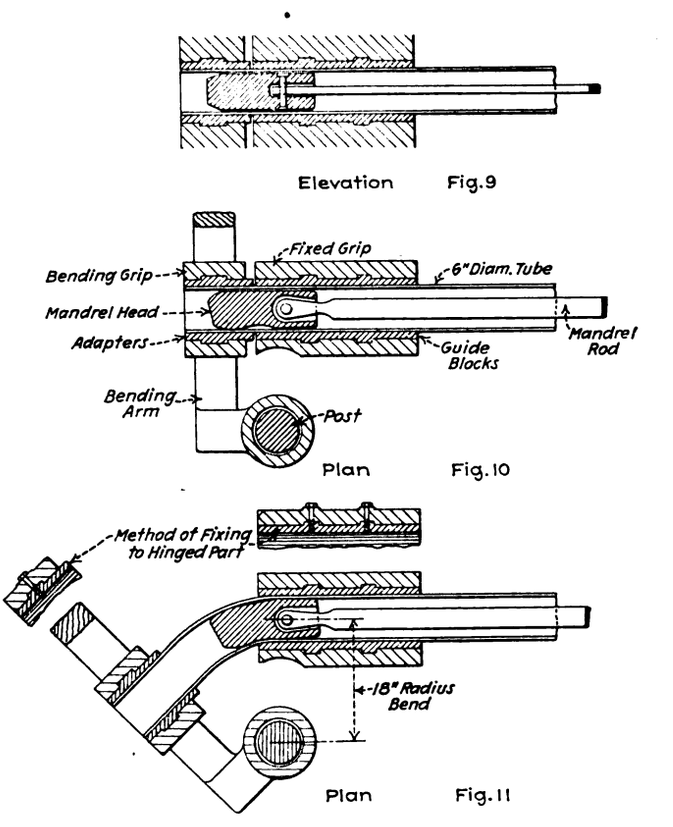
The machine, which is illustrated in Figs. 1 to 11, consists essentially of a bending grip adjustable on a free swinging arm; a fixed grip, which guides the tube; an adjustable pusher actuated by a hydraulic ram, which drives the tube forward from the rear end, and a special mandrel anchored by a mandrel rod to the crosshead of the withdrawing ram. No formers are employed in making the bends and no gearing of any kind enters into the working of the machine.

The bending grip comprises a hinged clamp, fastened by means of knuckle bolts in order to ensure quick action, holding the adapters which enable it to take firm hold of the tube. The grip can be moved along the arm in order to give the correct radius of bend, by means of a screw or a rack and pinion. The arm swings freely about the post and is driven round when a bend is being made by means of the bending tube. The fixed grip comprises a similar, though longer, hinged clamp, also fastened by knuckle bolts, holding the guide blocks through which the tube passes before it bends.

There is a set of adapters and a set of guide blocks for each outside size of tube. Each set of adapters and guide blocks consists of two half-cylindrical shells. One set is quickly interchangeable with any other set and both adapters and guide blocks are so light that the largest sizes are easily handled by one man. In the case of the adapters the inner surface is toothed to prevent the tube from slipping through while in the case of the guide blocks it is smooth in order to allow the tube to be pushed through.

The mandrel is of special shape with two heads. The rearmost of these lies at or about the point at which bending commences. It is attached to the mandrel rod by means of a loose pin. There is a mandrel for each inside size of tube and the diameter is such that the mandrel is a loose fit in the straight tube. The same mandrel does for all bends which may be required in the same inside size of tube.

The pusher is attached to the crosshead of the main ram



Figs. 9-11.—Details of bending mechanism

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by means of pull rods upon which it is adjustable to suit the different lengths of tube. The crosshead itself is fitted with a vice which can grip the tube and so prevent it from deflecting during the bending action.

The bending action is as follows. The arc and radius of the bend having been determined or read off from a set by means of a chart or radius board, the bending grip is adjusted upon the arm by the screw so that the correct radius is read off the scale on the arm and the post is adjusted by means of its screw to suit.

The bending grip, if not in position, is swung into line with the fixed grip by simply pushing it round into position by hand.

The clamps are now opened and, if the correct adapters and guide blocks are already in place, the tube is laid in place so that the point at which the bend is to commence registers with a mark on the fixed grip with the seam, if a welded tube, either to the top or bottom, or if that is not possible, to the outside of the bend. The clamps are then closed and tightened by means of the knuckle bolts. The next operation is to adjust the pusher on the pull rods, so that it rests against the end of the tube, and to close the vise on the crosshead. The mandrel rod, with the requisite mandrel attached, is now threaded, rear end first, from the front, or bending end, of the machine through the tube and the pusher and the rear end attached to the crosshead of the withdrawing ram by dropping in the pin.

Everything is now ready for bending and pressure is admitted to the main ram which causes the pusher to drive the tube forward through the fixed grip and the bending tube to follow the bending grip as it swings round the post. When the correct arc of bend is indicated on the index, in sight of the operator on the head of the post, the pressure is cut off from the main ram and admitted to the withdrawing ram which pulls the mandrel back into the straight portion of the tube.

When the tube is bending on the mandrel it flattens slightly between the heads of the mandrel at or about the position of the maximum bending moment and this ensures that bending takes place only in this region. As the tube passes over the foremost head it is brought up to full diameter and comes into a region of diminishing bending moment so that it is henceforth strong enough to resist any further bending or other distortion. When the mandrel is withdrawn at the end of the bending process the flattened portion remaining between the mandrel heads is pulled out and the bend is then full bore throughout without any wrinkle or other irregularities and perfectly smooth.

The maximum deflection from full bore in a 6-inch diameter tube is about $\frac{3}{16}$ inch, that is about 3 to 4 percent of the diameter of any tube when bent to minimum radius. The radius of the bend is the same from start to finish and the tube is the same length over its center line after as before bending, hence no allowance has to be made on this account. The outside wall of the tube is thinned less by this than by any other process of bending and the bends are stronger under pressure than the original tube.

A following bend may be produced by opening the grips, pushing the tube forward the necessary distance (which must not be less than the minimum distance required to give enough straight tube for the bending grip to hold (about 1¼ to 1½ diameters of the tube), closing the grips, readjusting the pusher and the radius, if required, admitting pressure to the main ram, etc., as before. The plane of a following bend can be arranged at any angle to the plane of a previous bend by turning the tube through the necessary amount before the grips are reclosed. Coils can be produced by making half or quarter bends and turning the tube the necessary amount between each bend to give the necessary pitch.

When the last bend in a length of tube is completed the grips are opened and the tube slipped out of the machine.

Machines are built to the following standard sizes:

First—To bend tubes up to 3 inches diameter.
Second—To bend tubes up to 4½ inches diameter.
Third—To bend tubes up to 6 inches diameter.
Fourth—To bend tubes up to 8 inches diameter.

The range of diameters of the standard machines is from the maximum diameter given down to a minimum of half this diameter. The maximum arc of bend is 220 degrees and the minimum radius for good quality solid drawn or welded steel tubes is three diameters for tubes whose thickness is not less than 1/24 of the mean diameter.

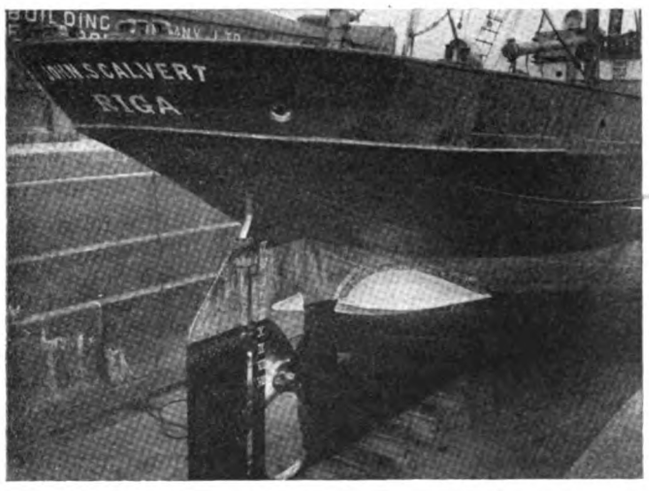
One of the chief advantages of the machine is the rapidity with which bends may be produced on it. Some idea of its present capacity may be gathered from the fact that a 6-inch machine worked by one man and his helper can turn out 10 to 12 bends of varying radii in the largest sizes of tube in one hour or from 80 to 100 bends in three diameters per 8-hour day.

Tubes are lubricated, both on the outside part to pass through the fixed grip and on the inside portion to pass over the mandrel, with some form of cheap lubricant such as oil, wagon grease or soft soap.

These machines, owing to the quality of the work they turn out and their rapidity of action, are becoming increasingly popular in Europe, especially for ship work. They are used in the Royal Dockyards of the British Navy, and are manufactured by Hugh Smith and Company, Ltd., Glasgow, Scotland.

The Pescod Speed Wing Fin

THE novel device shown in the illustration has been fitted in England on the steamers *S. E. Calvert* and *J. S. Calvert* and also upon several small launches. As the illustration clearly indicates the object is to turn the flow of water coming from under the vessel from an upward



S.S. John S. Calvert in dry dock, showing installation of wing fins to direct flow of water to propeller

to a more nearly horizontal direction, thus increasing the efficiency of the propeller. It is claimed that the use of this device results in a very material decrease in fuel consumption, better steering qualities and reduced hull vibration.

ANNUAL MEETING OF INSTITUTION OF NAVAL ARCHITECTS.—The annual meeting of the Institution of Naval Architects will open in London on April 6. Papers for presentation at the meeting are being considered by the council.

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Accident Prevention on Tank Steamships*

Texas company stimulates safety thinking on board ship by display of safety posters

By Arthur M. Tode†

VIRTUALLY every accident on board ship is preventable. A careful study of the accidents, which occurred on board the vessels of the Texas Company's fleet during the years 1923 to 1925 inclusive, and an analysis of the injuries which resulted made it apparent that relatively few of the accidents could be classed as unavoidable. In fact, the majority of the accidents could have been prevented by greater carefulness and watchfulness on the part of the men injured, and in some cases, by co-workers who were either partly or entirely responsible for the accidents.

The problem of promoting safety on board ship resolves itself into one of education and proper supervision. The first part, that of education, consists in a mental training

SAFETY FIRST
A SECOND'S FORGETFULNESS MAY CRIPPLE YOU FOR LIFE!
KEEP OUT OF BIGHTS
Stand clear of lines under strain
FIRE!
What Would Fire at Sea Mean to YOU?
Every Man in the Crew Must Help to Prevent Fire!

One of the "Safety First" bulletin boards installed by the Texas Company on its vessels

of all the personnel to think of safety and to follow out the principles which promote safety in their daily tasks. Recognizing that mechanical appliances play but a comparatively small part in accident prevention and that the greater proportion of accidents is attributable to the human factor, an effort must be made to arouse the interest of the worker in the safety of himself and his co-employees. The individual man on board ship must be taught that his safety depends largely upon himself, just as does the safety of others. The second part of the problem, that of proper supervision, requires the co-operation and assistance of every member of the marine department from the highest executives down to the ordinary seamen, wipers and messmen.

Proper supervision must include men and machinery. The licensed personnel on the ships who frequently complain of the inexperience of the men in their charge must be taught to realize their own responsibility for this condition and make serious efforts to train and instruct the men under them.

The management in turn, must find ways and means to arouse an interest among the officers on the ships so that the principles of safety will, through them, be indelibly impressed upon the men. This is important because the turnover of the unlicensed personnel is large in proportion to the officer personnel replacement.

The executives of a steamship company, especially one engaged in the oil tanker trade, when attempting to inaugurate or follow out an accident prevention campaign have not the same facilities or opportunities to pursue this work as are available in general factory or plant management on shore. Here there are a large number of ships carrying their cargoes of crude and refined oils to ports on the several continents. In the tanker trade a quick turnabout is of the greatest importance. Before reaching the loading port the crew of a tank vessel is busily engaged making all preparations to take on board the oil cargo immediately upon arrival. Not infrequently an oil tanker will reach her loading port in the morning, and before the sun has set will have started on her return voyage. In the interim a cargo of some 60,000 or more barrels of oil has been pumped into her tanks, several hundreds of tons of package freight securely stowed in the 'tween decks and holds, and bunker fuel, boiler feed water and commissary stores loaded. At the same time such repairs and adjustments have been made to the machinery as may have been required, and the many miscellaneous duties, both on deck and in the engine room, which must be attended to have received proper attention.

Upon the vessel arriving at her discharging port a similar picture is presented. The safety representative of the oil company would receive but little encouragement from the master or chief engineer of the ship, who together with their men are exceedingly busy at these times, should he attempt under such conditions to talk to their crews on accident prevention. The safety representative of a general passenger or cargo steamship company, whose vessels are in port from one to several weeks at a time, may, perhaps, have the opportunity of personally talking to and impressing upon the men the company's ideas of safety.

In the oil tanker trade the voyages of the respective ships are largely governed by the law of supply and demand—both domestic and foreign trade. With loading terminals on the southern and western coasts of the United States, in Mexico and in South America, and with many discharging ports at home and abroad, it is difficult and in many cases impossible to determine the itineraries of the vessels for any considerable future period. Under these conditions the safety representative may not have the opportunity, much as he may desire, of visiting some of the ships excepting at very long intervals.

The Texas Company, upon serious consideration of the best means to reduce the accidents on board its ships, found itself confronted with the difficulties which have been very briefly mentioned. It appeared that a good start toward reducing the number of accidents could be made by stimulating "safety thinking" among the sea-going personnel, by attempting to create good will for accident prevention work among the men, and to remind them of the care that must be exercised to perform their duties with the highest degree of safety for themselves and their fellow workers. It therefore was decided to display safety posters on all

*Abstract of paper presented before marine section at fifteenth annual congress of National Safety Council, Detroit, October, 1926.

†Superintendent, technical division, marine department, The Texas Company, New York.

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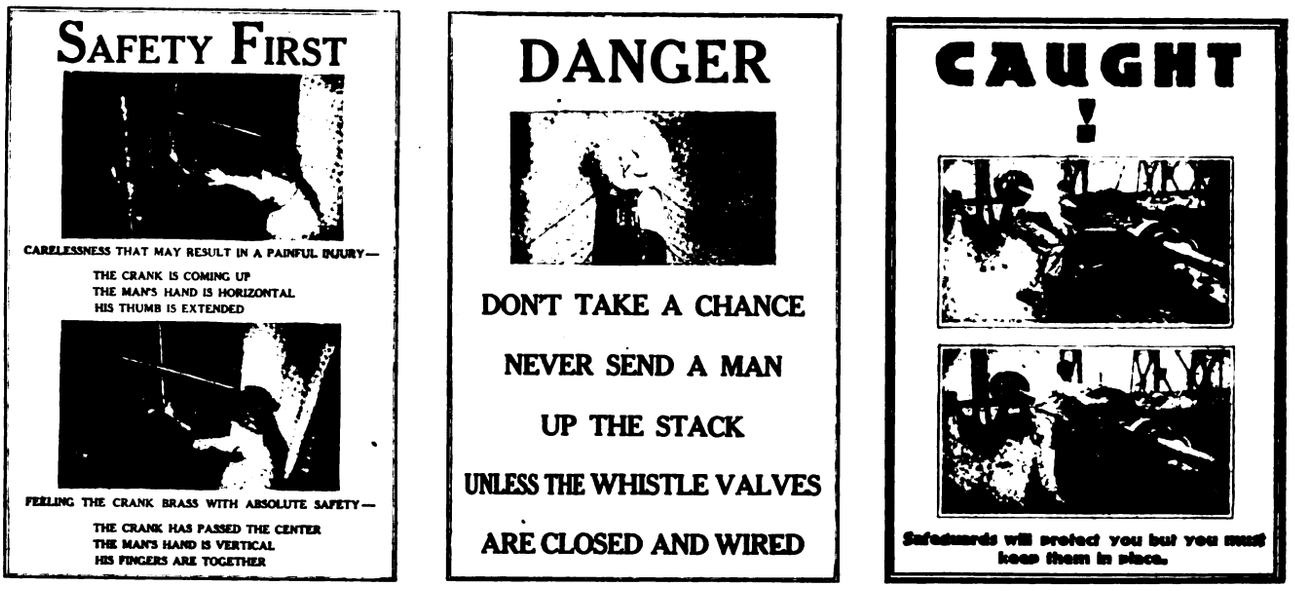
SAFETY FIRST
CARELESSNESS THAT MAY RESULT IN A PAINFUL INJURY—
THE CRANK IS COMING UP
THE MAN'S HAND IS HORIZONTAL
HIS THUMB IS EXTENDED
FEELING THE CRANK BRASS WITH ABSOLUTE SAFETY—
THE CRANK HAS PASSED THE CENTER
THE MAN'S HAND IS VERTICAL
HIS FINGERS ARE TOGETHER
DANGER
DON'T TAKE A CHANCE
NEVER SEND A MAN
UP THE STACK
UNLESS THE WHISTLE VALVES
ARE CLOSED AND WIRED
CAUGHT
!
Safeguards will protect you but you must keep them in place.

Samples of the Safety First posters used by The Texas Company

vessels of the ocean-going fleet, the barges and tugs, and at the several marine warehouses.

As the preparation of a large number of original safety articles and posters for display purposes would entail considerable time, the poster catalogue of the National Safety Council was consulted. Of the many hundreds of splendid posters thus available only a comparatively few are applicable to marine work. These, for the most part, have been contributed by the marine department of another large oil company. About 70 posters finally were selected with which to start an accident prevention campaign. Various types of bulletin boards for displaying the safety posters were considered and two sizes of boards chosen.

The boards are of a neat appearance, one size being 18 inches by 24 inches overall, for the large vessels, the other being 18 inches by 12 inches overall, for the small fleet. A metal sign "SAFETY FIRST" is attached at the top of each board. On the large ships two bulletin boards have been placed (each displaying two safety posters), the latter being changed weekly by the master of the vessel. On the barges and tugs only one bulletin board has been installed, displaying one poster which is changed weekly. Lack of space on the latter craft made it necessary to furnish them with the smaller size boards.

Considerable thought was given to selecting the most desirable locations for installing the boards on every ship, that is, to select places where the majority of the crews would voluntarily or involuntarily be brought in contact with the department's ideas of safety. In the majority of cases the safety posters are being displayed simultaneously in the officers' mess room and in the crew's mess room, although in some instances other locations were selected.

All the bulletin boards and the complete sets of safety posters for the ships were assembled at one office and, together with complete instructions for their installation and display, were sent to the marine superintendents at the several terminals of the company for delivery to the vessels upon their next arrival in port. In addition, letters outlining the marine department's plans for lowering the accident record were sent to all masters and chief engineers.

Consultations are being held with the officers of our ships along this line of work as the opportunity offers. Their interest and co-operative spirit is gratifying and should be the contributing factor toward a successful accident prevention campaign. Material is being gathered in order that original safety posters may be prepared by the Texas Company to be used when the present supply has been depleted. As these safety posters are finished from time to time copies will be submitted to the National Safety Council in Chicago so that other steamship companies and allied industries may use them. Such co-operation, it is felt, in addition to other ways should and does assist to promote safety at sea on board ships of those companies who are members of the marine section of the National Safety Council.

A Review of Electrical Developments in the Marine Field for 1926

By D. W. Niven*

A DISCUSSION of the theoretical advantages of various applications of steam and Diesel machinery is always of great interest, but it is also well to summarize briefly at various times the part that electrical equipment is playing in the actual installations.

In this way it is possible to get a clear picture of the tremendous yearly growth in the use of electricity on merchant type vessels, and the place that the engineering organizations of the large electrical manufacturers are taking in this development.

In scanning the work of the General Electric Company in this field during the past year, we find the following interesting facts:

Self-Unloading Bulk Freighter

As a result of the successful operation of a 13,000-ton self-unloader type of bulk freighter equipped with turbine-electric drive and electrical unloading equipment, which was put into service in July, 1925, a still larger ship of this class is now under construction.

It will be the largest bulk freighter on the Great Lakes, with an overall length of 637 feet and a beam of 65 feet. and its entire equipment will carry out the most advanced engineering practice both in regard to the steam conditions and to the completeness of the electrification of its auxiliaries.

The turbines will be supplied at 300 pounds pressure and a total temperature of 700 degrees F., and will operate on

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a vacuum of 28½ inches. These steam conditions represent a distinct advance both in regard to pressure and temperature for ships of this class.

The power developed will be normally about 4,200 shaft horsepower, but the equipment is capable of giving a maximum continuous output of 4,800 shaft horsepower.

The electric auxiliaries for use under way are driven from a motor-generator set which operates from the main unit while the electric equipment for unloading cargo in port is driven directly from the main unit. Under way a

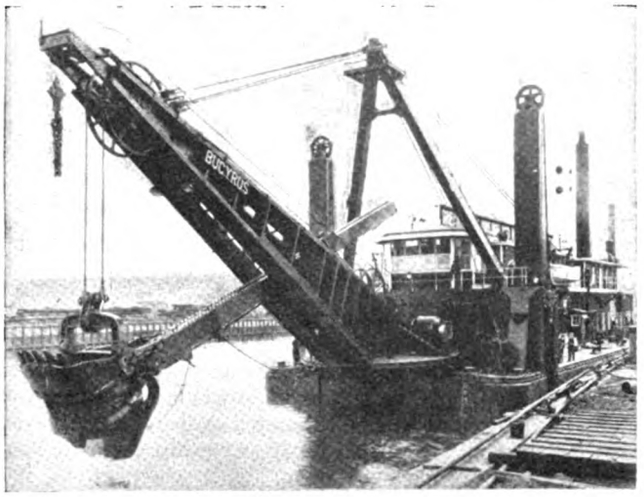

Fig. 1.—Diesel-electric dipper dredge Crest

variation in the revolutions per minute of the propeller is accomplished by varying the speed of the turbine. In port, the main turbine will be run at constant speed, and, in case maneuvering is required simultaneously with the unloading operation, variation in the propeller speed can be accomplished by means of resistance inserted in the propelling motor secondary circuit.

TANKERS

Diesel-electric propelling equipment is under construction for three tankers of 7,000 dead weight tons each. These are single screw ships and the generating equipment for each consists of three 525-kilowatt 250-volt direct current machines driven by three 850-brake horsepower engines, each generating unit being provided with a 50-kilowatt direct connected auxiliary generator. The three main generators are normally operated in series and supply current to an 1,800 shaft horsepower 90-revolutions per minute 750-volt shunt wound propelling motor.

These ships were purchased from the United States Shipping Board by the Atlantic Refining Company and were originally steam operated, but experience with similar craft provided with Diesel-electric drive resulted in the adoption of this method of propulsion.

The control will be arranged for operation either from the pilot house or the engine room. All the auxiliaries will be electrically operated and will receive their current supply normally from the 50-kilowatt auxiliary generators, but a 35-kilowatt standby Diesel engine driven generator will be available for emergency and port service.

DREDGES

The first Diesel-electric dredge on the Great Lakes, the *Sandmaster,* was placed in service in May and is the most advanced vessel of her type in the world today.

Like the tankers just referred to, the *Sandmaster* was originally a United States Shipping Board craft and operated by steam, but her conversion to Diesel-electric drive permitted not only more economical operation of the propelling machinery but also rendered possible the most flexible arrangement and control of the large pumps and other auxiliaries required for the operation of a suction dredge.

With an overall length of 263 feet and a beam of 43½ feet, the main machinery consists of two 600 horsepower engines with 400-kilowatt 240-volt direct connected generators which supply current to two 500 horsepower 130-revolutions per minute motors that are direct connected to the twin screws. Each of these driving motors can be controlled independently from either the pilot house or the engine room.

The two main sand pumps are each electrically driven by a 400 horsepower 450-revolutions per minute motor and the two jetting pumps by 125 horsepower 1,700-revolutions per minute motors. Some idea of the effectiveness of this dredge can be gained from the fact that it is capable of handling 3,000 tons of sand per hour through a maximum pipe line length of 8,000 feet, and can build up a hill of sand 90 feet high at that distance from the source of supply.

The auxiliaries, which are all electrically operated, include the steering gear, anchor and mooring windlasses, etc., in addition to the main pumping units.

A new 15-inch hydraulic dredge for the U. S. Navy utilizes 3-phase 60 cycle alternating current motors. The main dredge is equipped with a 600 horsepower 165/265-revolutions per minute motor, and the cutter with a 75 horsepower 300/600 revolutions per minute motor. The main dredge motor operates at 2,200 volts, but 220-volt service is provided for the auxiliary equipment.

The most powerful dipper-dredge ever constructed, the *Crest* (Fig. 1), was placed in service and is now being used in rock removal work in New York Harbor. The

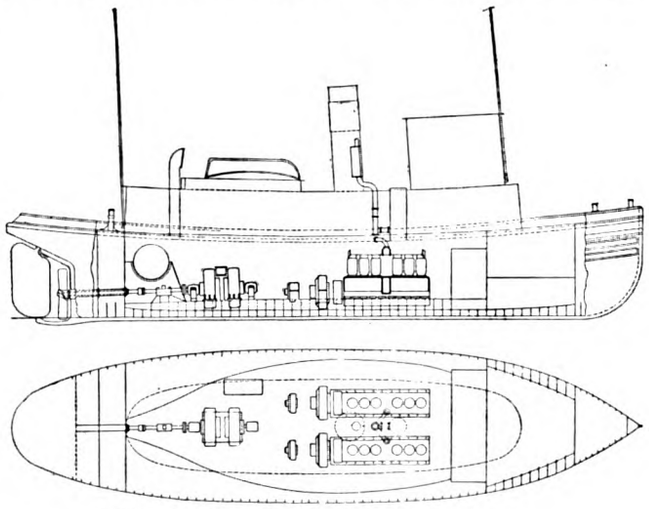

Fig. 2.—New York Central tug boat

primary power consists of two 600 horsepower Diesel engine driven generators and more than 1,400 horsepower in motors is required for the dredging operations. At present, 10-cubic yard dippers are being used on account of the severity of the work, but in normal service buckets up to 15 cubic yards can be utilized. The pull on the dipper bail is 350,000 pounds, or more than twice that of the largest size dredges used in the construction of the Panama Canal.

SOUTHERN PACIFIC FERRY BOATS

Propelling equipments for four Diesel-electric ferries represented a greater power for this type of craft than has heretofore been used.

These ferries are under construction for the Southern Pacific Railroad Company and each of these double-ended

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boats will be equipped with four 275-kilowatts direct current generators individually driven by four 450 horsepower engines, the two propellers being each driven by a 1,250 horsepower 1,000-volt double armature direct-connected motor.

The control apparatus will be so arranged that the vessel may be maneuvered direct from either of the two pilot houses or the engine room. The electric lighting system and all auxiliaries will be supplied with current by the

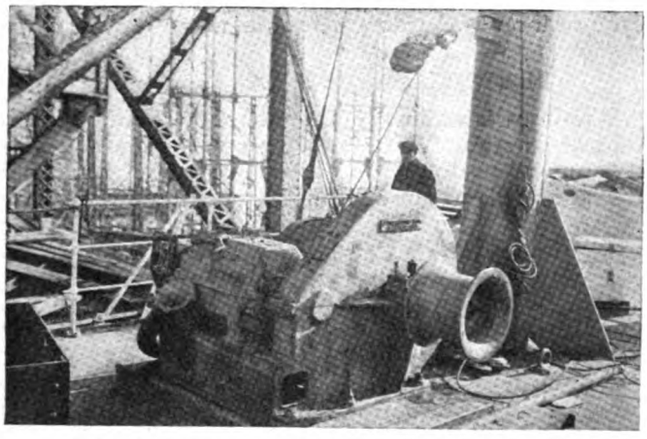

Fig. 3.—Electric cargo winch on M.S. East Indian

auxiliary generators. A standby auxiliary generator driven by a gas engine is provided for emergency operation of the lights and principal auxiliary motors.

TUG BOATS

Two tug boats which are under construction at the Balboa shops for service on the Panama Canal will be the largest and most powerful Diesel-electric craft of their type, each having a maximum continuous rating of 900 horsepower and an overall length of 150 feet.

Two tugs, each 108 feet long and 26 feet beam, under construction for the New York Central Railroad, are indicative of the most modern arrangement of Diesel-electric propelling machinery (Fig. 2) for this type of craft. Each boat will be provided with two 270-kilowatt 265-revolutions per minute 240-volt compound-wound generators, each driven by a 400 horsepower Diesel engine, the propelling motor being of the double-unit type and rated at 650 horsepower 480 volts and being normally operated by the two generating units connected in series.

The type of automatic mooring winch which was originally designed for marine service was successfully applied for mooring an airship to the Ford airmast at Detroit, and its satisfactory operation has resulted in the decision to equip the Scott Field mooring mast near St. Louis with a similar machine.

An electric automatic towing machine was installed on the tug *William A. Lydon* operating on the Great Lakes.

The electrical equipment comprises a 50 horsepower motor, a contactor panel, and two master switches: one an automatic switch operated from the tension-responsive device in the mechanical gearing, and the other a manual switch.

IMPROVED MOTOR OPERATED DECK WINCH

Improved operating characteristics were secured in the design of a new single geared type of motor operated deck winch (Fig. 3) having the advantage of an automatic accelerating control feature which limits the current used regardless of the manner in which the control handle is operated. A number of these new winches have already been placed in service.

In previous types of deck winches, standard rated motors were employed and necessitated the use of double gearing. Therefore, at average cargo loads, the motor speed was quite high and involved considerable accelerating losses. Current consumption and peaks were also high.

In the new winch, the driving motor is designed so that a minimum accelerating torque is required on average loads. Single geared operation is therefore feasible and quicker acceleration and more rapid cargo handling is secured with a reduction in the amount of current consumed. Due to the relative mechanical simplicity, there is also effected a saving in weight and the deck space required for installation.

The master switch for the control of the winch provides 4 points rheostatic hoisting and 5 point power and dynamic braking lowering. The motor keeps pace with the control handle, and even an untrained operator does not require to spend a long time in getting the "feel" of it.

Diesel-Electric Dredge Saves $2,707 in One Month

LAST spring the Construction Materials Company, Chicago, Ill., placed in service the twin-screw hopper dredge *Sandmaster*, described in our September, 1926, issue. The power plant of this hopper dredge consists of two Worthington Diesel engines direct connected to electric generators which furnish the power for driving the propelling motors, auxiliaries and the sand pumps for loading, unloading and the making of sand fills. A smaller Worthington Diesel-electric generator set is provided to take care of the power requirements in port.

This company operates a fleet of dredges, one of which is the *Sandcraft*, a sister ship of the *Sandmaster* except that it is steam driven. In deciding on the use of Diesel-electric drive for the *Sandmaster*, the owners anticipated substantial savings in fuel and in labor costs, also additional economies in the elimination of delays in starting and stopping, getting under way, fueling and in making adjustments.

During the month of September the *Sandmaster* and the *Sandcraft* both performed approximately the same work, affording an excellent opportunity to compare operating costs on a fair average basis. For this month fuel and labor costs for the motorship *Sandmaster* were $2,707.24 less than for the steamer *Sandcraft*. In addition, anticipated savings in fueling time and in starting, stopping, getting under way and in making adjustments were realized.

Trial Trips

(*Continued from page* 4)

the apparent mean thus being 10.2 knots. If we presume that these two conditions were actually and respectively experienced on the trials of sister ships, it follows that an apparent difference of 0.40 knot or 12 percent in efficiency may easily be introduced by the methods of trial analysis now in almost universal commercial use."

Everyone who has had experience with commercial ship trials must recognize the existence of conditions similar to those outlined and the consequent impossibility of drawing accurate conclusions as to the interrelation of revolutions, power and speed from the average shipyard trial. Such information is urgently needed, it has a very real commercial value and any method which gives promise of extracting it from data usually available to the shipbuilder and ship operator is of an importance not easily overestimated. Experience along the lines suggested by him will, we are convinced, demonstrate that Dr. Telfer has rendered a service to the profession which, while it may not now be recognized at its full value, is sure to be as time goes on.

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Practical Instructions for Handling Wire Rope

Data, supplied by the American Cable Company, New York, show how to measure, uncoil or unreel and lubricate wire rope

THERE is only one correct way to measure wire rope and that is shown in contrast to the incorrect method by Fig. 1. It is highly important that the proper size of rope be employed since an undersized rope will not give the degree of service that should reasonably be expected, while an over-sized rope represents needless investment. More important, however, is to have the rope and the sheave properly fitted.

No wire rope should be allowed to travel over a sheave

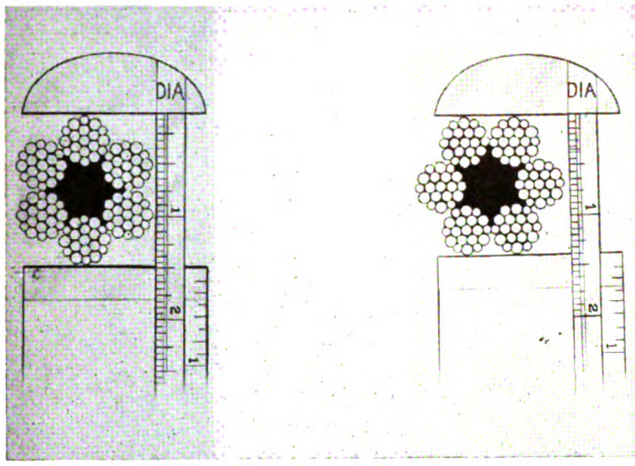

Fig. 1.—Illustrating by contrast the correct and incorrect methods of measuring wire rope

wherein the groove is too small for the diameter of the rope. A pinching groove will do more damage to a wire rope in one hour than a properly sized groove in an entire week or more. Sheaves groved $\frac{1}{16}$ inch larger than the diamter of the rope will lengthen the life of the rope many times

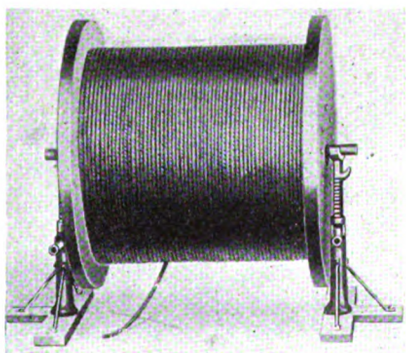

Fig. 2.—Jackbrackets provide the best means for unreeling wire rope

as compared with rope life on pinching sheaves. Since sheaves are cheaper than good wire rope, there is small economy in continuing the operation of improperly grooved sheaves or drums.

Tread diameter of drums or sheaves also greatly effects wire rope life. Wherever possible, large diameter sheaves should be used, for the bending stresses are thereby reduced. Reverse bends should also be eliminated where possible since such reverse bending is wont to greatly diminish rope service.

How to Uncoil or Unreel Wire Rope

Wire rope is ordinarily shipped and received either in coils or on reels. When uncoiling or unreeling wire rope it is very essential that no kinks are allowed to form. Once a kink is made no amount of twisting or strain can take it

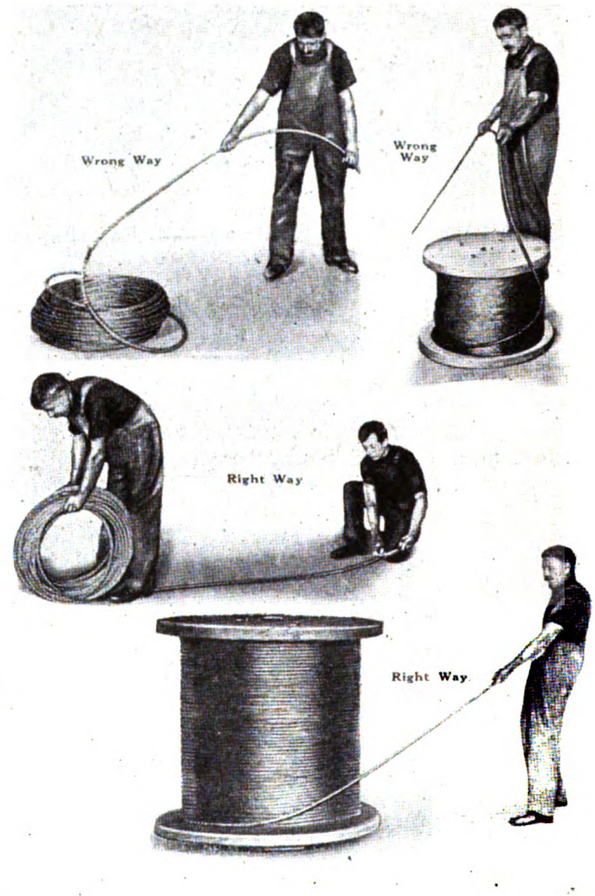

Fig. 3.—Right and wrong methods of handling wire rope

out and the rope is unsafe for work. Never uncoil a wire rope as might be done with a rubber hose or manila hemp rope. Lift the coil to its edge and unroll the coil, allowing the rope to lie flat until used. Contrasting methods are shown in Fig. 3.

When wire rope is received on a reel it must never be taken off or unreeled as shown in the "wrong way" illustration, for such a method will invariably develop kinks and spoil the rope. If a jackbracket for the reel is unavailable (as shown in Fig 2) turn the reel on edge and roll along the ground.

Lubrication of Wire Rope

Practically all the cores of good brands of wire rope are thoroughly impregnated with a commercial, chemically-neutral rope oil. While the core retains a liberal supply of

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this lubricant which gradually oozes out as the rope is used, still, frequent application of a good lubricant during service is necessary to prevent the core from becoming dry. A dry core will both wear and crush quicker than an oil-impregnated core. Furthermore it will absorb moisture with the result that the core will deteriorate rapidly and the inner wires will corrode with shortened rope service as the result.

The smaller the sheaves or the heavier the tension on the rope, the more often should the rope be lubricated. A good lubricant retards corrosion of the wires and deterioration of the core, reduces internal friction which is the cause of wires breaking from bending stresses, and decreases external wear. The lubricant should be thin enough to penetrate the strands and the core but not so thin as to run off the rope nor so thick that it merely covers the rope.

Therefore, a thicker, semi-plastic compound applied *hot* and in a thinned condition, is the best wherever possible. It will penetrate while hot, then cool to a plastic filler, excluding the entrance of water, both preserving and lubricating the inner wires and cores.

To properly lubricate with a heated lubricant, it is necessary to have the rope run slowly through a tank of heated oil. This is the best possible method to allow penetration. Where this is not possible, an application of a thinner and unheated lubricant will give better practical results.

It is always well to lubricate the rope just after installation and before running in service, particularly when such ropes have been kept in storage for any length of time.

Launch of the Airplane Carrier U. S. S. Lexington*

Experiments, investigations and arrangements made for checking the vessel when launched and results obtained

By S. W. Wakeman†

ON APRIL 7, 1925, the airplane carrier *Saratoga* was successfully launched from the ways of the New York Shipbuilding Corporation, at Camden, N. J. This launch has been very well described in a paper read before the Society on November 12 and 13, 1925, by E. H. Rigg, Council Member.

The airplane carrier *Lexington,* now under construction for the United States Navy, was launched from the Fore River Plant of the Bethlehem Shipbuilding Corporation at Quincy, Massachusetts, on Saturday morning, October 3, 1925, at 11:15, Eastern Standard Time.

The *Lexington* and *Saratoga* are sister ships, being built from similar plans; but on account of differences in the launching calculations and arrangements, the problems which had to be solved at the Fore River Plant were of such a nature, and the methods of solution used so different from anything ever tried in this country before, that we are making this record for possible help at some future time.

The *Lexington* is the largest ship in weight ever launched in this country; and only two heavier vessels have ever been launched in the world, these being transatlantic liners. Her general dimensions are as follows:

Length over all	888 feet
Length between perpendiculars	850 feet
Breadth, molded at bulge	105 feet 3¾ inches
Breadth, molded at flying deck	105 feet 8 inches
Depth, molded to flying deck at center	74 feet 3 inches
Launching weight of ship, long tons	25,517
Launching weight of ship and cradle, long tons	26,897

SPECIAL PROBLEMS

Cambered Ways.—The rise and fall of the tide at Quincy averages about 10 feet, but in order to insure a depth of water over the end of the ways which would keep the way-end pressures low without unduly extending the ways, it was decided that the ground-ways should be cambered instead of straight.

Way-End Pressure.—The problem of way-end pressure was very important. Extra rivets were placed in the longitudinals over the ways so as to relieve the shearing stresses in way of maximum way-end pressure, and steel internal shoring was also fitted in this region. The curve of way-end pressure is given in Fig. 1.

Snubbing and Checking.—The biggest problem encountered during the preliminary work of launching was how to snub the *Lexington* at the proper time and make her stop at a distance of 200 feet from the way-ends to the forward perpendicular. It was necessary to dredge a berth into which to launch the *Lexington.* The dredged area gave a clear run of 1,395 feet from the way-ends, and as the waterline length for the *Lexington* is 850 feet, only 545 feet clearance was available under any condition.

After a great deal of study, it was decided to drag piles of chain along the ground, also to fit a wooden mask over the after end of the cradle, and to lock the propellers positively so that certain resistance might be obtained from them.

It was planned to stop the ship with her bow 200 feet from the way-ends by the use of these chain cable drags on each side, and to connect these by wire rope to strong steel pads and removable pins on the ship's sides in way of the middle half deck.

The first obstacle encountered was the true coefficient of resistance of each chain drag, using its weight as a basis for comparison.

We were very much surprised at the lack of definite information on this subject, and, owing to the size and weight of the ship and the energy involved, we decided to experiment with these drags.

At an estimated speed of 25 feet per second, the amount of kinetic energy developed with a launching weight of 26,897 tons figured out to be 261,360 foot-tons, and as it was not considered advisable to attempt to do any checking by means of chain drags until the forward end of the cradle was within 60 feet of the end of the ways, the problem became one of absorbing practically this amount of energy in 330.5 feet travel.

Chain-Drag Experiments.—In November, 1923, a preliminary series of tests was made in order to determine this coefficient as well as to observe the action of the drag while turning over. Five runs were made, one with a drag weight of 20,780 pounds, and four with a drag weight of 15,920 pounds of 2½-inch chain. The piles were laid in the form of a horseshoe with the bow facing away from the direction of the pull, and the hauling line was led to a 4-ton spring dynamometer located upon a special type of

* Abstract of paper read before the Society of Naval Architects and Marine Engineers, November 12, 1926.

† Vice-president and general manager of the Bethlehem Shipbuilding Corporation, Ltd.

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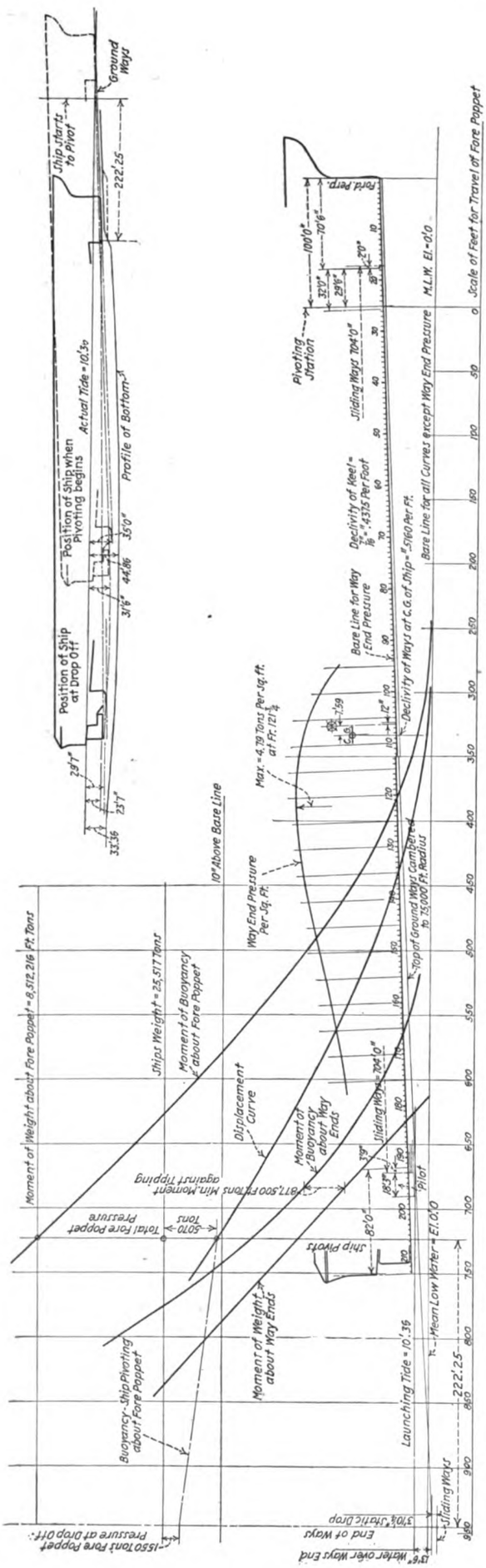
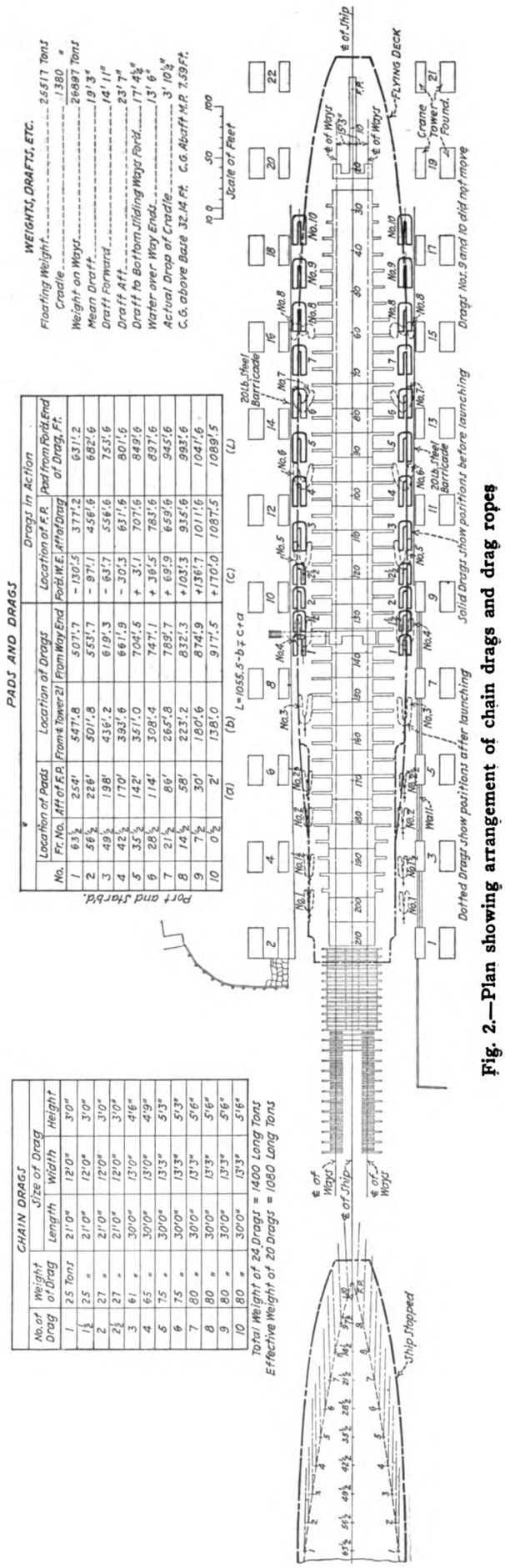

Position of Ship at Drop Off
Position of Ship when Pivoting begins
Actual Tide = 10.3'
Profile of Bottom
Ground Ways
Ship starts to Pivot
Pivoting Station
Sliding Ways 704'0"
Declivity of Keel = 4315 Per Foot
Declivity of Ways at C.G. of Ship = 5760 Per Ft.
Base Line for all Curves except Way End Pressure
Base Line for Way End Pressure
Max. = 4.79 Tons Per Sq. Ft. at Ft. 121½
Way End Pressure Per Sq. Ft.
10" Above Base Line
Moment of Weight about Fore Poppet = 8,512,216 Ft. Tons
Ship's Weight = 25,517 Tons
Moment of Buoyancy about Fore Poppet
Displacement Curve
Moment of Buoyancy about Way Ends
Moment of Weight about Way Ends
Buoyancy - Ship Pivoting about Fore Poppet
Total Fore Poppet Pressure
5010 Tons
817,500 Ft. Tons Min. Moment against Tipping
Ship Pivots
Pilot
Mean Low Water = El. 0.0
Launching Tide = 10'.35
Sliding Ways
Launching Ways
Water over Ways End
End of Ways
5104 Static Drop
1550 Tons Fore Poppet Pressure at Drop Off
Scale of Feet for Travel of Fore Poppet
Scale of Feet

Fig. 1.—Static launching curves of U. S. S. Lexington

Notes: (1) Ship launched from ways No. 10 on October 3, 1925, at 11:15 a. m. eastern standard time. (2) These curves are drawn for actual conditions at time of launch, except that static conditions are assumed and weight and buoyancy of cradle are not considered.



No.	Location of Pads Fr. No.	Aft of F.P.	From Tower 21	From Way End
1	63½	254'	547'.8	507'.7
2	56½	226'	501'.8	553'.7
3	49½	198'	436'.2	619'.3
4	42½	170'	393'.6	661'.9
5	35½	142'	351'.0	704'.5
6	28½	114'	308'.4	747'.1
7	21½	86'	265'.8	789'.7
8	14½	58'	223'.2	832'.3
9	7½	30'	180'.6	874'.9
10	0½	2'	138'.0	917'.5

(a) (b) $L = 1056.5 - b + c + a$ (c)

No.	Location of Drags Fwd. W.E. Aft of Drag	Dist from Fwd. End of Drag, Ft.
1	- 130'.5	377'.2
2	- 97'.1	456'.6
3	- 63'.7	556'.6
4	- 30'.3	631'.6
5	+ 3'.1	707'.6
6	+ 36'.5	783'.6
7	+ 69'.9	859'.6
8	+103'.3	935'.6
9	+136'.7	1011'.6
10	+170'.0	1087'.5

(d)

No. of Drag	Weight of Drag	Size of Drag Length	Width	Height
1	25 Tons	21'0"	12'0"	3'0"
1½	25 "	21'0"	12'0"	3'0"
2	27 "	21'0"	12'0"	3'0"
2½	27 "	21'0"	12'0"	3'0"
3	61 "	30'0"	13'0"	4'6"
4	65 "	30'0"	13'0"	4'9"
5	75 "	30'0"	13'3"	5'3"
6	75 "	30'0"	13'3"	5'3"
7	80 "	30'0"	13'3"	5'6"
8	80 "	30'0"	13'3"	5'6"
9	80 "	30'0"	13'3"	5'6"
10	80 "	30'0"	13'3"	5'6"

Total Weight of 24 Drags = 1400 Long Tons
Effective Weight of 20 Drags = 1080 Long Tons

Fig. 2.—Plan showing arrangement of chain drags and drag ropes

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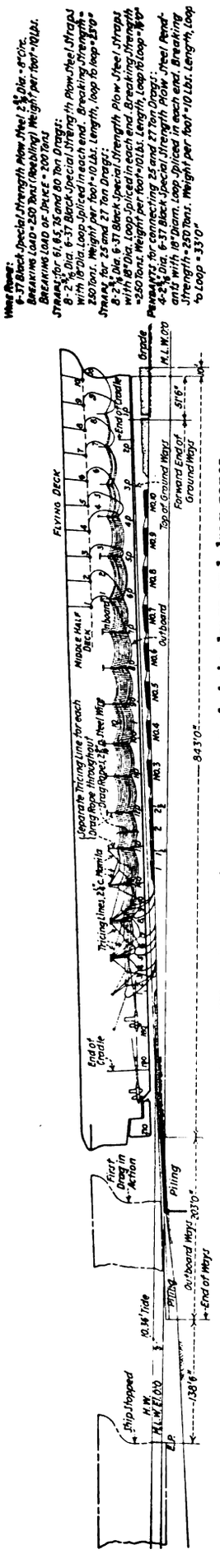
Wire Rope:
6-37 Black Special Strength Plow Steel 2 1/16 Dia. = 6" Circ.
Breaking Load = 250 Tons (Reeling) Weight per foot = 10 Lbs.
Breaking Load of Splice = 200 Tons
Strand: for 61, 65, 75 and 80 Ton Drags:
8-2 1/16 Dia 6-37 Black Special Strength Plow Steel Strand with Iarola Loop Spliced in each end. Breaking Strength = 250 Tons. Weight per foot = 10 Lbs. Length, loop to loop = 130'
Strand: for 25 and 27 Ton Drags:
8-2 1/16 Dia 6-37 Black Special Strength Plow Steel Strand with 18" Dia. Loop Spliced in each end. Breaking Strength = 250 Tons. Weight per foot = 10 Lbs. Length, Loop to Loop = 130'
Pendants: for connecting 25 and 27 Ton Drags:
4-2 1/16 Dia 6-37 Black Special Strength Plow Steel Pendant with 18" Diam. Loop Spliced in each end. Breaking Strength = 250 Tons. Weight per foot = 10 Lbs. Length, Loop to Loop = 33'-0"
Flying Deck
Middle Half Deck
Upper Deck
Tricing Line for each Drag Rope Throughout
Drag Rope 2 1/16 Dia. Steel Wire
Tricing Lines, 2 1/2 Dia. Manila
Top of Ground Ways
Forward End of Ground Ways
End of Cradle
First Drag in Action
Piling
Outboard Ways 2010'
End of Ways
843'10"
576'4"
40'
H.W. Tide
Ship Stopped
H.W.
M.L.W. El. 0.00
138'6"

Fig. 3.—Elevation showing arrangement of chain drags and drag ropes

flat car. This dynamometer was provided with a recording apparatus so that a continuous record of the pull of the chain pile could be obtained, and the flat car was hauled by one of the yard locomotives. The ground over which the chain was hauled consisted of clay covered with cinders. From the results of these tests, which were conducted at hauling speeds varying from 5 to 10 feet per second, it was found that the coefficient of friction averaged about 0.4 while the pile was turning over, and about 0.7 afterwards. The graphical records showed that the pile turned over practically without shock.

Further study of the ground conditions beneath the ship showed that the concrete bed-logs forming a part of the slip foundations were partly above ground as well as partly in the path that the chain drags would take in their movement down the ways. Consequently it was feared that the drags might pile up against these concrete bed-logs and result in the breaking of the wire rope drag lines. Two solutions were possible for overcoming this difficulty, one being to fill in the spaces between the bed-logs so that their upper surface would be buried to a certain depth, and the other to cut off the outer ends of the bed-logs and fill in the hole caused by their removal.

Because of these considerations, a second group of tests was undertaken, the idea being to use larger weights, as well as to ascertain the coefficient of friction of the chain drags over the filled-in type of ground contemplated for the slip-way.

A special roadway was constructed of broken stone and gravel well tamped down. Then a pile of chain cable in the shape of a horseshoe, with the bight away from the direction of pull, was laid down. A wire rope hauling line was fastened to the bight of the chain and this led to a special car attached to two locomotives. On this car was located a 30-ton dynamometer and its recording gear.

A load of chain of about 35 long tons was used for the No. 1 test. This was dragged until the two locomotives were held to a full stop. Readings were then taken, and the maximum drag resistance was computed as 70,900 pounds. This divided by the total weight gave a coefficient of 89.75 percent. Two other drag tests were made with the resulting coefficients of 91.84 and 97.05 percent. The mean of the three tests gave a frictional resistance of 92.88 percent of the drag weight. These figures will vary for different ground conditions, but when coarse gravel is encountered and the great wave of ground which piles up in front of the chain is considered, it is not surprising that these large frictional coefficients were obtained.

During the launch the third to sixth drag units on each side plowed down to a depth of about 18 inches below the normal surface level.

The foregoing is a single illustration of the time spent and the care taken to prove every step of the design work, in order that guesswork could be eliminated and knowledge and success be attained.

Arrangement of Drags and Lines.—The general arrangement of the chain drags and drag-lines used in checking the travel of the ship is clearly shown by Figs. 2 and 3. The chain cable used for this purpose was arranged in twelve U-shaped piles on each side of the ship, the curved portion of the U being placed forward so as to enable each chain pile to turn over or pull through without the tremendous shock which would occur if the whole load were accelerated instantly from no velocity to a velocity of over 20 feet per second. It should also be noted that the weight of the chain in the various drags was varied from 25 tons in the first two drags to 80 tons in the last four.

The chain drags were connected to special forged pads placed along the ship's side, in way of the middle half deck, by means of ten wire rope drag-lines on each side. The wire rope used for this purpose was of black, special strength plow steel consisting of 6 by 37 wires, having a diameter of $2\frac{9}{16}$ inches, and tested to a breaking strength of about 500,000 pounds. It withstood the tremendous stresses in every way.

To be on the safe side, the drag and distance calculations were finally based on a coefficient of drag resistance to weight of 65 percent. It was also arranged that the first drag should come into action while the cradle still overlapped the ground-ways for a distance of 60 feet, the estimated velocity of the ship at this instant being about 22.4 feet per second.

The actual performance gave a velocity when the first drag started of 20.7 feet per second, and the coefficient of drag resistance to weight worked out about 83 percent as an average. This factor, together with the water resistance of the ship, cradle, mask, fixed propellers, and the friction of the grease, caused the *Lexington* to stop with her bow 138.5 feet from the end of the ways, a most satisfactory result.

Model for Arrangement of Drag-Lines.—The arrangement of the wire rope drag-lines connecting the chain piles to the ship was a difficult problem and was studied in advance by means of a half-block model. This model was made to a scale of one-sixteenth of an inch to a foot, and a runway representing the ground-ways was provided for it, so that it could be slid down by hand and the conditions existing at any point in its travel examined in detail.

One of the most important items in the arrangement of the lines and drags was the fact that the latter should come into action successively instead of all at once, so that the ship would not be subjected to any undue strain; furthermore, the lines and drags had to be so arranged that no weight should start before the one ahead of it and climb up on top of it. Here the advantage of using a rigged model is apparent, since by its use the exact position at which each

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drag-line came taut, and its weight started to move, could be easily determined.

No attempt was made to launch this model into water nor to simulate any of the features of the checking action of the chain drags. The model was simply used to check up the length of the drag-lines, to study their arrangement and the action of the rope stops which supported them, and

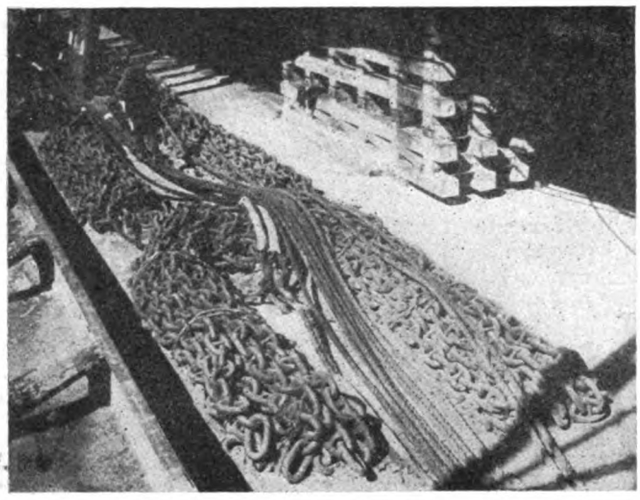

Fig. 4.—Drag ropes as finally laid down, showing drags Nos. 1 and 1½

to determine when the weights would start and the approximate path they would take.

Laying of Drag-Lines on Chain Piles.—As can be seen from Fig. 3, each drag-line was led aft a sufficient distance to take up its length and was then carried forward from its aftermost rope stop and secured to its chain pile. Several methods for keeping the lines clear of the chain piles

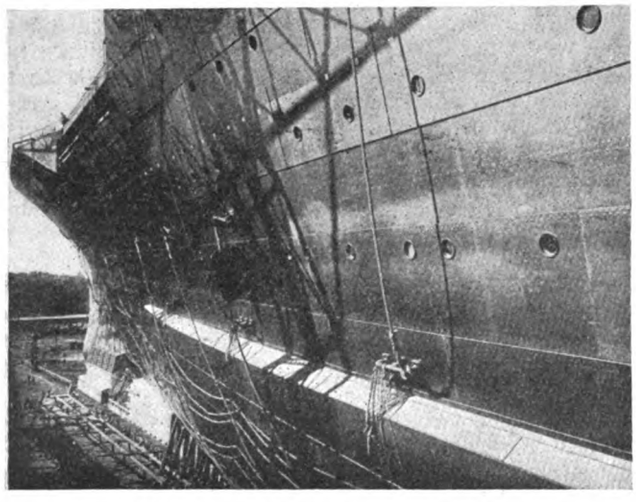

Fig. 5.—Drag ropes forward, port side

were studied but had to be given up on account of their complications and disadvantages.

The arrangement finally adopted is clearly shown in Fig. 4, which shows the lines as laid on top of chain piles Nos. 1 and 1½ on the port side. The view is taken looking forward, and the ten lines are laid in numerical order starting with No. 1 outboard, and ending with No. 10 inboard.

Velocity of Ship While Being Launched.—A very complete analysis was made of every available velocity curve pertaining to the launching of large ships, both naval and merchant, and a curve of estimated velocity worked out for the *Lexington* which showed a maximum velocity of 25 feet per second.

The actual maximum velocity obtained was 26.7 feet per second.

Energy Analysis.—A rather approximate analysis of the energy and work done during the launching of the *Lexington* shows that the total work done by gravity was about 1,020,000 foot-tons, this being equal to the product of the weight of the ship and the vertical distance through which the center of gravity of the ship moved in passing from its original position on the ways until the ship was afloat. Of this amount it is estimated that the chain drags absorbed about 11½ percent, or about 117,500 foot-tons, a relatively small amount when compared with the total work done by gravity. When compared, however, with the 152,500 foot-tons of kinetic energy possessed by the ship on

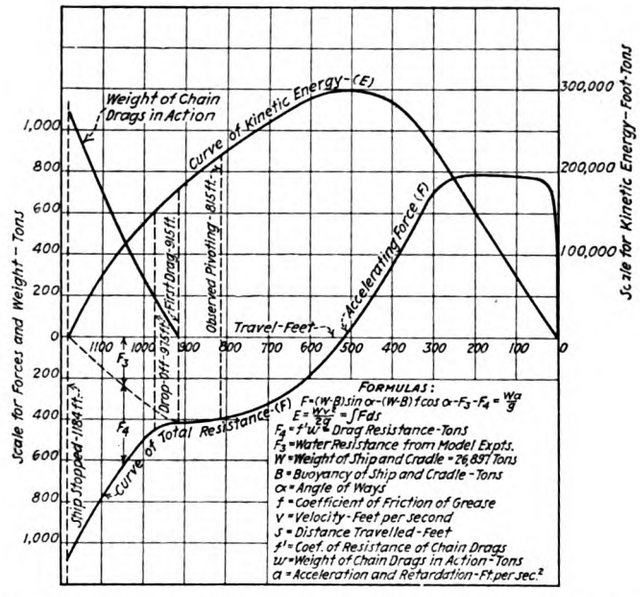

Fig. 6.—Curves of energy and resistance during launching

Note: The curves of kinetic energy, accelerating force and total resistance are calculated directly from the observed velocity and acceleration, Fig. 9. The curve of water resistance (F_3) was determined by model experiments, and the curve of weight of chain in action is calculated from the weight of and distance traveled by each drag.

leaving the ways, it is seen that the chain drags absorbed over three-quarters of this latter amount, thus conclusively demonstrating their effectiveness.

Experiments to Determine Water Resistance.—For the purpose of analysis and of obtaining additional information concerning the water resistance of the *Lexington* during launching, a series of model experiments was undertaken at the Massachusetts Institute of Technology in the spring of this year by lieutenants (J. G.) J. C. Huske and W. H. Magruder, both of the Construction Corps of the U. S. Navy.

While complete information concerning these experiments is not available at the present time, their results seem to indicate that the curve of water resistance for the *Lexington* will be approximately that given in Fig. 6. Based on this curve, the coefficient of resistance of chain drags averages about 0.85.

Ground-Ways.—The ground-ways were built up of eight 12-inch by 12-inch long leaf yellow pine timbers, in lengths of 35 feet, with 1¼-inch diameter through-bolts, nuts, and washers; the four outside timbers of each section were stepped forward 6 feet to allow scarfing. The overall length of the ground ways was 993 feet 9 inches; the effec-

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tive length, or length from the outer end of the fixed ways to the forward end of the sliding ways, was 978 feet; the width was 8 feet. They were cambered to the arc of a circle 75,000 feet in radius. The ground ways were inclined inboard transversely to a grade of ⅜ inch per foot of width. The starting slope of the way under the center of gravity of the ship before launching worked out to about 0.516 inch per foot.

The slope of the keel was $\frac{7}{16}$ inch, or 0.4375 inch, per foot of length.

Sliding Ways.—The sliding ways were built up of 12-inch by 13½-inch long leaf yellow pine timber, 35 feet 6 inches long, with square ends, the timbers being dressed so that the finished section was 7 feet 10 inches wide by 35 feet long.

The timbers were through-bolted with 1¼-inch bolts spaced about 2 feet 3 inch centers and having nuts and washers on each end.

The end of each section had steel plates with steel bosses, properly bolted; through these plates 2½-inch diameter steel bolts were run; then over these bolts were placed 50-pound steel cheek plates, 8 inches wide by 4 feet 6½ inches long; the bolt ends were stopped by ½-inch by 6-inch steel split pins.

The overall length of the sliding ways was 722 feet 3 inches; the effective length, or the actual bearing length that takes the weight of the ship, was 704 feet; and their width was 7 feet 10 inches.

Cradle.—Over the sliding ways, which were spread 30 feet 6 inches center to center, were placed the white oak wedges, spaced about 17 inch centers, each wedge being 8 inches wide by 10 feet long; and from the wedges the yellow pine timber packing was fitted snugly to the ship, this material being placed horizontally for the cradle in general; at the after end, or the so-called after poppet, three tiers of 12-inch by 12-inch timbers were placed over the wedges; then from these, six vertical timbers were erected at each frame, fitting snugly to both ship and timber, each section being secured by steel plate straps, bolted at both ends; distance pieces and diagonals were fitted to hold these vertical timbers in place.

Glut blocks of yellow pine timber were fitted to the outside of the main cradle (between the fore and after poppets) through which were run the 2-inch and 2¼-inch tie rods, with large steel plate washers and nuts on the outside.

Owing to the fine form of the vessel it was necessary to install between the fore poppet and the forward end of the main cradle for a space of 22 feet a structural steel subpoppet. Two and a half inches of soft wood packing was used between the ship and the steel straps to allow for settling and adjustment. The straps were of 40-pound plate 12-inches wide, located on the frames and half-frames, or 2 feet apart.

The fore poppet was built up of plate straps, steel brackets, and 12-inch by 12-inch vertical yellow pine timbers with five tiers of 3-inch by 3-inch clear straight grain yellow pine crushing strips, properly spaced to keep the poppet pressure evenly distributed while pivoting (Fig. 7).

The five medium steel plate straps, each of double 40-pound plate, and 5 feet wide, were run under the ship's bottom and then up each side to about the 16-foot level. A departure from the usual practice was here made; viz., instead of following the contour of the ship's side, the straps were all molded to the same form, to allow easier yard work. Between the straps and the outside plating a mixture of 1—3—3 cement, coke, and sand was poured.

A 40-pound horizontal strap plate, 48 inches wide, was run the full length of the poppet, 32 feet, to tie up the straps, brackets, and timbers. On the outside a face bar of 4-inch by 4-inch by 15.7-pound angle was riveted.

White oak gluts, 14 inches by 14 inches, were placed on the outside, and through these 2¼-inch tie rods were run, set up with large turn buckles and nuts.

The total fore poppet area, both sides, was 500 square feet, and the pressure per square foot was about 10 tons.

Owing to the fineness of the ship at the after end and the necessity for the proper support of the overhung weight, special attention was given to the after poppets of the ship.

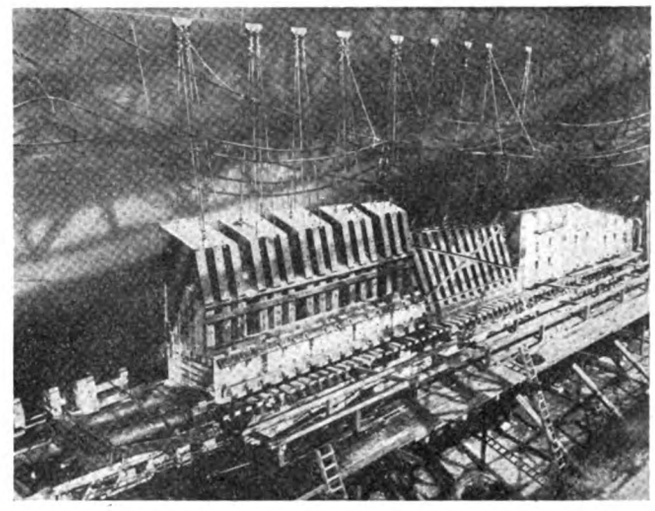

Fig. 7.—Fore poppet, port side

For a distance of 96 feet from the after end of the cradle, horizontal straps were fitted, being bolted in to the upright shores. In between these straps, similarly built straps were fitted, to take the shape of the ship, and were brought through the vertical shoring and bolted through by channel iron gluts. This entire arrangement is well illustrated in Fig. 8.

Internal shoring was installed to brace the ship's sides

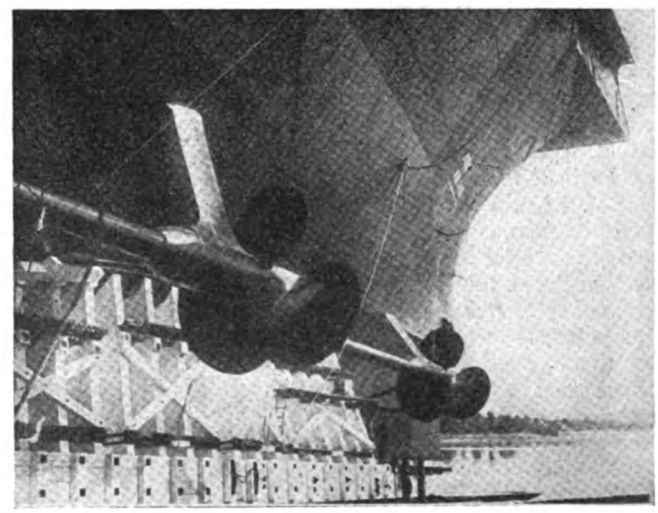

Fig. 8.—After poppet and propellers, port side

in way of the fore poppets in the inner bottom and machinery spaces amidships to care for the way-end pressures, also in the store rooms aft, and after motor rooms in way of the cradle. There was no indication anywhere inside the vessel that the expected pressure had been exceeded.

Releasing and Starting Arrangements.—Four hydraulic rams and triggers of the standard type were used, two at each way, located at two-thirds length abaft of forward perpendicular. The large steel casting housing the triggers

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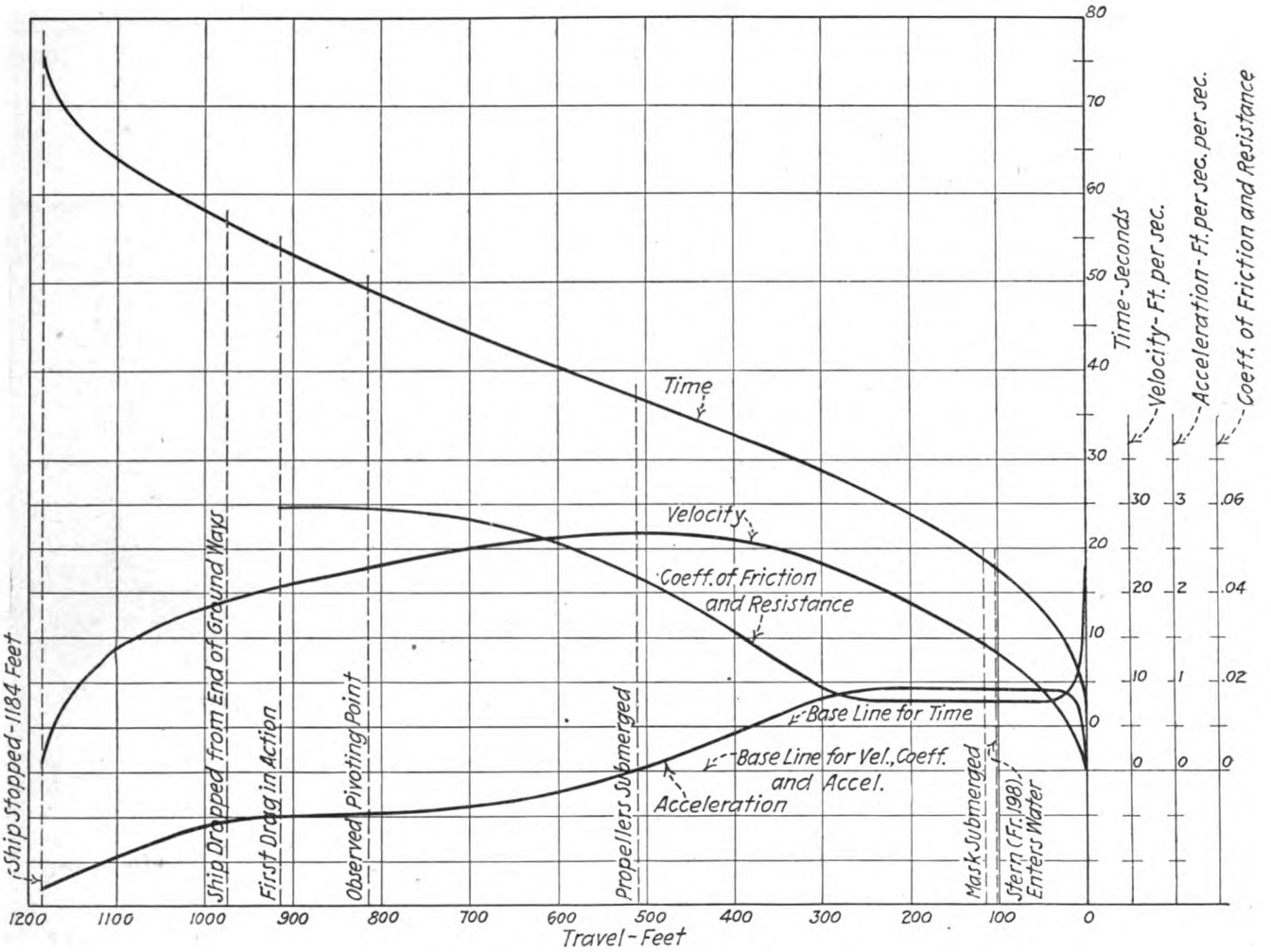

Fig. 9.—Observed launching data

was built into the ground-ways, and then a heavy casting built into the sliding ways to engage the upper end of the triggers. The cylinders were 14 inches diameter; the actual gage pressure registered was 1,675 pounds per square inch for each cylinder. The calculated downward pull of the ship just before the release was 1,157 long tons. At 1,675 pounds per square inch, the pressure on the gage connected to the trigger cylinders corresponded to the pressure on the sliding ways, or the triggers, of 640 long tons.

Tumble Shores.—The coefficient of starting resistance equals 0.0238, which includes the resistance of the grease, and that of the thirty-four 14-inch by 14-inch tumble shores, 17 on a side, underneath the docking keels, which were fastened top and bottom so that, as the ship moved, they would fall inboard and out of the way of the chain drags. These tumble shores rested on the concrete bed-logs at the bottom, and a steel plate was fitted at the top, with a 2-inch yellow pine piece between this plate and the bottom of the ship. These shores were set out ⅛-inch per foot from a line normal to the keel, and were canted forward. All keel blocks were cut out, and the vessel started without using the jacks about four minutes after the release of the triggers. After the launch it was found that the steel plates on the top of these docking keel tumble shores had compressed into these yellow pine blocks about ⅜ inch, and some of the concrete bed-logs were broken, which explains the four-minute interval between the release of the triggers and the actual apparent movement of the ship.

Starting Rams.—For forcibly starting the ship in case she refused to move, there was installed a very complete outfit of hydraulic rams and piping at the fore poppet and along the ways. There were two 150-ton jacks at each poppet end forward, and three 75-ton jacks at frame locations of 72, 107, and 164 port and starboard, with special hydraulic piping and fittings connecting all into one unit. A push of 1,050 long tons capacity could be exerted simultaneously at the application of 2,400 pounds per square inch pressure through the system. It was not, however, found necessary to use this system.

Speed Observations.—In order to obtain the velocity and acceleration of the *Lexington* at various distances traveled, three methods were used. First, twenty-one white marks were painted on the ship's side in the usual manner and two sighting stations for these were established, one just forward of the stern, and the other at the end of the adjacent wharf. The time for each mark was recorded as usual by means of stop-watches. Separate marks and observers were also located at the head of the ways in order to obtain the time for the first 3 and 6 feet of travel.

Second, a speed recorder was placed in one of the crane towers. The recording mechanism for this was wired to a contact-maker secured to the ground-ways about 100 feet from the stern of the vessel, and the contact-maker was operated by steel pins driven into the sliding ways directly under the white paint marks referred to in the preceding paragraph.

In addition to these two methods, a chronograph, loaned by the Portsmouth Navy Yard, was placed in one of the crane towers at the bow, the wire from its drum being led through sheaves and secured to the forward end of the

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cradle. The chronograph functioned perfectly throughout the whole travel of the ship, and a record was obtained which agreed very closely with those obtained by the other two methods.

The curves plotted from the observations are given in Fig. 9.

Lubrication.—The launching stearine and grease was applied to a total depth of ⅞ inch, the stearine going on hot, and the grease applied cold, by hand. Paragon stearine was used as a base coating to a depth of ⅝ inch. This material withstood the heavy fore poppet pressure splendidly. At no place on the ways was there less than about ½ inch of solid stearine after the launch. Neptune grease, ¼-inch thick, was used as a slip coat over the stearine and worked very satisfactorily.

The total amount of lubricant used was as follows: Stearine, 46,000 pounds; grease, 17,200 pounds; oleo-stearine, 13,658 pounds; total, 76,858 pounds.

The oleo-stearine was for slushing the under side of the sliding ways and the first coat on the under-water portion of the ground-ways.

The absence of any trace of smoking should be noted as rather an exceptional condition in connection with a launch of this magnitude.

Handling the Ship after Launching.—As soon as the ship had stopped and had fallen back toward the shore somewhat until the drag-lines were slack, the pins which held the drag-lines in the pads on the side of the ship were easily pulled out by the block-and-tackle arrangements already described. The drag-lines, thus released, slipped out of the pads. Then seventeen tugs took the ship in tow, backed her clear of the dropped ends of the drag-lines, and moved her to her wharf, where she was tied up in 64½ minutes from the moment of her full stop, a rather remarkable feat in itself.

Special Features.—Communication with the various principal stations could be had at any time by means of a complete, self-contained telephone system installed just prior to the launching. This arrangement eliminated the usual running around to check conditions and give the necessary signals.

A special main station was located at the mouth of the trigger pit tunnel, where a complete log was kept of every action taking place. The chief recorder could at any instant give the exact rise of tide, settlement of ground-ways, trigger cylinder pressures, creeping movement, and the progress of removing the shores, cribbing, and keel blocks.

A special signal circuit was used to notify the sponsor, Mrs. Theodore Douglas Robinson, wife of the Assistant Secretary of the Navy, who in turn threw a special lever switch that gave the signal to the trigger operators to release the trigger.

The christening of the ship with the orthodox bottle actually took place at the bow of the ship about half an hour before launching, as there was a special danger at the bow station, owing to a possibility that some of the wire drag-lines might break and then snap back to this location. The observation stand was located at the side of the building slip.

Every possible item of danger was studied, and its prevention worked out to insure that no workman or visitor could be injured. This phase of the launching worked out perfectly.

A special 20-pound structural steel barricade was erected on each side of the ship and outside of the piles of chain drags for protection to the bases of the overhead structure, and also to confine the drags to a straight course.

The general data for the launchings of the *Lexington* and *Saratoga* may be conveniently compared as follows (data for the *Saratoga* are taken from Mr. Riggs' paper):

	Lexington	*Saratoga*
Dimensions of vessels, feet	888 by 106 by 74	888 by 106 by 74
Date of launch	October 3, 1925	April 7, 1925
Time of launch	11:15 A. M.	1:15 P. M.
Place of launch	Quincy, Mass.	Camden, N. J.
Weight of ship, etc., tons	25,517	24,630
Weight of cradle, tons	1,380	1,100
Total launching weight, tons	26,897	25,730
Length of ground-ways, effective	978 feet	932 feet
Length of sliding ways, overall	722 feet 3 inches	712 feet
Declivity of keel, per foot	.4375 inches	.5364 inch
Declivity of ways, per foot (initial)	.516 inches	.5364 inch
Camber of launchways	75,000 feet rad.	None
Bearing area, square feet	11,000	10,500
Initial mean press. tons per square foot	2.45	2.45
Width of ways (sliding)	7 feet 10 inches	7 feet 6 inches
Spread of ways, centers	30 feet 6 inches	27 feet 9 inches
Water over way-ends at launch	13 feet 6 inches	11 feet 4 inches
Static drop of ship	3 feet 10¼ inches	5 feet
Mean draft afloat, S. W.	19 feet 3 inches	18 feet 3 inches
Maximum way-end pressure, tons per square foot	4.8	15.1
Minimum moment against tipping, foot-tons	877,500	305,000
Pivoting pressure, tons	5,070	3,900
Height of tide, actual	10 feet 4⅝ inches	5 feet 6 inches
Height of tide, expected	10 feet 5 inches	6 feet
Maximum speed, feet per second	26.7	25
Drop-off speed, feet per second	19	22
Travel after drop-off, feet	209	985
Angle of slew, degrees	None	15
Width of groundways	8 feet 10 inches	7 feet 7½ inches

Consolidation of Lines Authorized

The Shipping Board on November 24, authorized the Emergency Fleet Corporation to proceed with the consolidation of the American Delta Line and the American Dispatch Line and to allocate the consolidated service to the Mississippi Shipping Company. The managing operator of the consolidated service is at the present time operator of the Delta Line.

The Delta Line has nine ships of aggregate deadweight tonnage of 74,765, and the Dispatch Line has six vessels of 49,708 deadweight tons. Both of the services are operated from Gulf ports to the East Coast of South America, although the Dispatch Line has been running its ships by way of New York. Under the plan for consolidation the New York call will be omitted, in order that this line may not compete with the American Republic's Line.

The board's action followed rejection on November 10 of a proposal received from the Munson Steamship Lines, Inc., present operators of the American Dispatch Line, for allocation of the service as now combined. The Munson proposition was submitted to the board in response to an advertisement for bids contemplating purchase of the line.

For the present a total of 16 ships will be operated on the combined service and the numbers will not be reduced until freight conditions warrant. It is intended, however, to effect economies in the maintenance of this trade route by a slight reduction in the number of ships kept in operation under the consolidation plan.

U. S. SHIPBUILDING REPORT.—The Bureau of Navigation, Department of Commerce, reports 45 steam, motor, sail and unrigged vessels of 23,237 gross tons built in the United States and officially numbered during the month of November, 1926. This total includes 6 rigged vessels of 14,781 gross tons built in years previous to 1926.

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An Investigation of the Behavior and of the Ultimate Strength of Riveted Joints Under Load*

By Commander E. L. Gayhart†

THE increasing use in recent years of high-strength structural steels, brought about primarily through the necessity for weight saving in the structural framing of large engineering units, has caused a reconsideration of a number of what had become accepted design rules. Among these, there is the question of the action and strength of riveted connections when made up of high strength plates fastened with high strength rivets. This problem is particularly applicable to ship plating, though common to all structural engineering practice, and is the more important where service requirements demand a minimum of weight with maximum strength and rigidity.

With these facts in mind, and a realization that the previous experimental work on riveted joints was non-conclusive especially as applied to the modern high strength steels, the Bureau of Construction and Repair of the Navy Department caused to be carried out the tests of riveted joints which form the subject matter of this paper. These tests were planned by the bureau in collaboration with Professor Hovgaard of the Massachusetts Institute of Technology and were performed at the Bureau of Standards.

The work was directed primarily to the study, under tensile forces, of slip phenomena and stress distribution in riveted joints. In addition, study was made of the effect upon the ultimate strength of the joint of variations in rivet spacing and attention was also directed to the effect of using rivets of a grade softer than the material of the plates.

Joint Types.—The joints were of the same overall dimensions as to length, width, thickness of plate material, thickness of straps, and diameter of rivets and rivet spacing. The variations, which were in the number of rows of rivets and in the matter of omission of rivets in the outer rows. All were double-strapped butt joints using a main plate of 30-pound material (approximately ¾-inch thick), and cover plates or straps of 20-pound material with 1-inch diameter rivets having pan heads and snap points. The joints were designed in accordance with navy standard procedure and represented standard ship practice.

Plate and Rivet Material.—Three grades of material were used for the main plates, respectively medium steel and high tensile steel which are standard navy materials for ship construction and special treatment steel which latter steel is used as ballistic protection. Two of these grades, the medium and the high tensile steels, were used for the straps.

Two grades of rivets were used, respectively medium steel and high tensile steel.

The plate and rivet materials were obtained from standard stocks and were not specially tested or selected.

Number of Joints.—The various combinations of material and of joint types resulted in seventeen kinds of joints. Three joints of each kind were made, resulting in the test of 51 individual specimens, enumerated in Fig. 1. These combinations permit a study to be made of the effect upon joint strength and behavior of:

1. Plate material as affecting rivet strength.
2. Variation in number of rows of rivets.
3. Omission of alternate rivets in the outer rows.

The data collected in the course of these tests were so numerous that no attempt can be made to present any of them in detail. The following conclusions are of interest:

*Abstract of paper read before the Society of Naval Architects and Marine Engineers, November 11, 1926.

†Construction Corps, United States Navy.

Summary of Conclusions

These conclusions, based upon the behavior of certain joints of a particular design, may not be strictly applicable to all types of riveted connection. However, the results obtained with these tests give valuable information upon riveted joint construction in general.

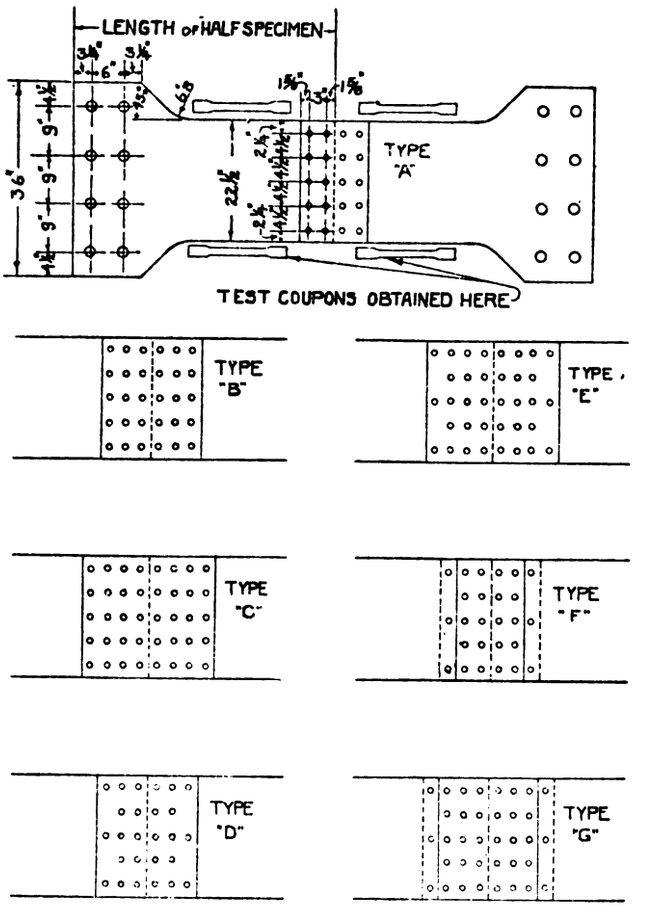

Fig. 1

Schedule of Tests

Type of Joint	Number of Specimens	Material: Plate	Material: Straps	Material: Rivets	Serial Numbers
A	3	M.S.	M.S.	M.S.	1-3
	3	H.T.S.	H.T.S.	M.S.	4-6
	3	H.T.S.	H.T.S.	H.T.S.	7-9
	3	S.T.S.	H.T.S.	M.S.	10-12
	3	S.T.S.	H.T.S.	H.T.S.	13-15
B	3	M.S.	M.S.	M.S.	16-18
	3	H.T.S.	H.T.S.	H.T.S.	19-21
C	3	M.S.	M.S.	M.S.	22-24
	3	H.T.S.	H.T.S.	H.T.S.	25-27
D	3	M.S.	M.S.	M.S.	28-30
	3	H.T.S.	H.T.S.	H.T.S.	31-33
E	3	M.S.	M.S.	M.S.	34-36
	3	H.T.S.	H.T.S.	H.T.S	37-39
F	3	M.S.	M.S.	M.S.	40-42
	3	H.T.S.	H.T.S.	H.T.S.	43-45
G	3	M.S.	M.S.	M.S.	46-48
	3	H.T.S.	H.T.S.	H.T.S	49-51

Note—For all joints: plate thickness, 30 lbs. (¾"); strap, 20 lbs. (½"); rivet diameter, 1". All rivets panhead and snap point spacing of rivets, edge distances, and spacing between rows as given for type "A" joint.

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TABLE 1.—SUMMARY OF RESULTS SHOWING ULTIMATE LOAD AND EFFICIENCY OBTAINED FROM TESTS OF RIVETED JOINTS

Type Designation	Description Number of Rows, Etc.	Stress in Main Plate At First Slip Pounds Per Sq. In.		Ultimate Load—In Units of 1,000 Lbs. Calculated and by Test. Tensile Strength of Material by Coupon Test (Lbs. Per Sq. In.). Efficiency on Gross and Net Section								
				Medium Steel					High Tensile Steel				
				Material Strength Per Sq. In.	Load		Efficiency		Material Strength Per Sq. In.	Load		Efficiency	
		Medium Steel	High Tensile Steel		Calculated (1,000 Lbs.)	By Test	Gross	Net		Calculated (1,000 Lbs.)	By Test	Gross	Net
R	Treble—All rows complete	9,400	4,000	59,760	749	824	84.0	110.0	80,740	1,019	1,089	81.7	107.0
D	Treble—Alternate rivets omitted in outer row	8,500	4,200	64,975	901	853	81.1	94.7	80,320	1,133	1,053	79.7	93.1
F	Treble—Unequal straps alternate rivets omitted in outer row ("Special")	6,500	3,800	65,725	907	902	85.0	99.5	81,600	1,131	1,113	81.1	98.4
C	Quadruple—All rows complete	10,900	4,400	65,308	806	868	82.3	107.6	79,970	1,008	1,060	80.3	105.1
E	Quadruple—Alternate rivets omitted in outer row	11,000	3,700	65,260	898	849	81.0	94.5	81,520	1,164	1,091	80.3	93.7
G	Quadruple—Unequal straps—Alternate rivets omitted in outer row ("Special")	8,300	4,100	65,310	918	905	84.3	98.5	78,550	1,127	1,096	83.0	97.3
A	Double—All rows complete	6,700	2,500 (erratic)	57,400	722	806	85.0	112.3	79,170	988	1,055	81.5	107.0

(*a*) *Relative to Slip Resistance.*—(1) When the joints are fabricated throughout of medium steel, the stress in the main plate at which slip first occurs increases with the number of rivets.

2. On account of a probable "quilting" action in the cover plates during the riveting of a multiple row joint, joints containing four or more rows of rivets show inferior slip resistance.

3. Symmetrical joints in which alternate rivets are omitted in the outer row show relatively the same rivet performance as shown by solid row joints. It is probable that the same conclusion applies to staggered riveting.

4. Joints in which one butt-strap is wider than the other give erratic performance and show inferior slip resistance as compared with symmetrical joints.

5. Neglecting the unsymmetrical joints, the lowest stress in the plate at which slip appeared was 6,000 pounds per square inch.

6. Joints fabricated of high tensile steel show resistance to slip greatly inferior to that shown by medium steel and so low that it appears doubtful whether any great portion of the load could be considered as carried by frictional forces. This suggests that joints made of high tensile steel would "pull loose" at low plate stresses.

7. The low slip resistance of high tensile steel joints seems to be primarily due to the initially warped condition of this material as compared with medium steel, also perhaps to a difference in the shrinkage of the rivets on cooling.

8. The few joints tested of special treatment steel showed characteristics similar to those of high tensile steel.

9. The slip resistance of high tensile steel joints is increased by the use of medium steel rivets.

10. In terms of single shear stress, the stress in the rivet at which the first slip occurs is so much lower than customary design shear stresses, and is so greatly affected by the number of rivets in the joint and the effects of eccentric loading and bending, that it does not appear desirable to design riveted joint construction on the basis of frictional resistance, but rather by the commonly used method of proportioning on shearing and bearing.

(*b*) *From the Standpoint of Joint Efficiencies.*—(1) Double strap butt joints failing in shear will develop the full theoretical shearing strength.

2. Where the plate material has not been left in the injured condition caused by punching, a plate failure through the net section of full-row chain riveting may be expected to show a strength in excess (possibly 10 percent) of the theoretical value.

3. The omission of alternate rivets in the outer row causes a loss in strength in the net section failure as compared with full-row riveting, and may even show less than theoretical strength.

4. Joints failing in shear gave an efficiency on gross section plate area of 76 percent.

5. Joints failing in tension (full row riveting) gave an efficiency of 80 percent on the gross section plate area.

6. Joints in which the alternate rivet was omitted in the outer row did not develop the efficiency that might be expected from their greater net section area. They showed an efficiency likewise of 80 percent, from which it appears that a tighter joint with greater slip resistance may be obtained

TABLE 2.—SUMMARY OF TEST RESULTS SHOWING PARTITION OF LOAD AMONG RIVET ROWS FOR VARIOUS MAIN PLATE STRESSES. VALUES ARE AVERAGE AF THREE JOINTS FOR TYPE

Stress in Gross Section of Main Plate Lbs./Sq. In.	Rivet Row Counting from Center	Percentage of Load Transmitted by Different Rivet Rows for Various Type Joints and as Affected by Material in Joints									
		A		B		C		D		E	
		M.S.	H.T.S.	M.S.	H.T.S.	M.S.	H.T.S.	M.S.	H.T.S.	M.S.	H.T.S.
5,000	1	20.0	27.3	20.0	18.2	22.2	0	18.1	37.5	20.0	30.0
	2	80.0	72.7	40.0	27.3	11.1	30.0	36.4	25.0	10.0	20.0
	3	....	....	40.0	45.5	22.2	30.0	45.5	37.5	40.0	30.0
	4	....	....	....	....	44.5	40.0	....	....	30.0	20.0
10,000	1	23.0	40.0	29.2	35.7	20.0	0	34.8	29.4	10.0	32.0
	2	77.0	60.0	37.2	28.6	10.0	34.8	26.1	29.4	25.0	20.0
	3	....	....	33.3	35.7	35.0	31.4	29.1	41.2	30.0	28.0
	4	....	....	....	....	35.0	34.8	....	....	35.0	20.0
15,000	1	23.0	38.3	30.6	24.4	23.5	8.6	36.0	24.1	14.3	32.5
	2	75.0	61.7	38.8	36.6	17.6	25.7	33.4	41.4	31.4	20.0
	3	....	....	30.6	39.0	29.4	28.6	30.6	34.5	28.7	22.5
	4	....	....	....	....	29.4	37.2	....	....	25.8	25.0
20,000	1	34.8	41.8	31.0	20.6	25.9	9.4	35.1	23.3	11.5	29.1
	2	65.2	58.2	39.6	38.0	24.0	20.8	35.1	41.8	40.4	18.2
	3	....	....	29.3	41.4	24.0	34.0	29.8	34.9	25.0	27.3
	4	....	....	....	....	25.9	35.8	....	....	23.1	25.4
30,000	1	33.7	37.2	38.6	21.3	28.3	8.2	35.6	21.9	14.0	25.3
	2	66.3	62.8	36.6	37.2	25.3	21.2	38.3	43.8	40.8	20.7
	3	....	....	24.8	41.5	24.2	34.1	26.1	34.3	20.4	26.4
	4	....	....	....	....	22.2	35.3	....	....	24.8	27.6
40,000	1	....	33.6	....	27.3	....	13.9	....	24.0	....	26.2
	2	....	66.4	....	28.0	....	19.7	....	38.5	....	18.9
	3	....	....	....	44.7	....	35.3	....	37.5	....	26.2
	4	....	....	....	....	....	31.2	....	....	....	28.7

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with full-row riveting without loss in the joint efficiency.

7. The unsymmetrical joint showed no advantage in efficiency over similar symmetrical types.

8. In shear failures, where the plate material is of higher grade than the rivets, the joint efficiency was slightly higher than would be expected from the rivets. The difference was so slight that the primary conclusion is that the use of the higher grade plate material does not work to the disadvantage of the rivets.

(*c*) *Relative to Load Partition among Rivet Rows.*—(1) Under low plate stresses, load partition depends on the frictional resistance of the joint.

2. The frictional resistance of a joint fails at such low plate stress that for practical purposes the load partition among rows may be considered as dependent upon the bearing and shear resistance of the rivets.

3. At low loads the outer row of rivets carries the greater proportion of the total load, the amount carried by the inner rows decreasing with the number of rows. The test results at low loads (except for double row joints) show fair agreement with theory.

4. Double-row joints in test show the outer row carrying initially 80 percent of the load and throughout the test never less than 66 percent of the load. This suggests that for important work the use of double-row joints is questionable.

5. As plate stress intensity increases, the proportion of the load carried by the first rivet decreases. This action tends to cause equalization of load between rivet rows and suggests the desirability of having only ductile material around rivet holes if good distribution is to be obtained.

6. The stress at which load equalization takes place increases with the number of rivets in the joint and may occur within commonly accepted design plate stresses, provided the joint does not have too great a number of rows. Practically, this means that for the more common type joints the usual assumption of uniform stress distribution is nearly true for the customary design plate stresses.

7. Equalization of load among rivets may be more difficult to secure with staggered riveting or chain riveting with the alternate rivet omitted in the outer row.

Conclusions Affecting Design

The foregoing conclusions, when considered as to their practical applicability, affect design in two respects; namely, from the point of view of ultimate strength and from the point of view of resistance to slip. Considering first the question of ultimate strength, we find that for double-strapped joints the following principles should govern:

1. Joints should be designed to have a shearing strength in excess of the calculated plate strength. They can then utilize the increase in strength conservatively amounting to 5 percent which the plate material shows over its strength by ordinary tensile test.

2. The question of omission of alternate rivets is to be determined by opposing considerations of holding calking, or of economy in rivets, the actual tearing strength being substantially the same whether the alternate rivets are omitted or not.

3. Working efficiency of joints with all rows complete is 1.05 $\times$ calculated efficiency.

4. Working efficiency of symmetrical joints with alternate rivets omitted in outer rows is 0.93 $\times$ calculated efficiency.

Considering next the question of resistance to slip, the inferior performance of the unsymmetrical joint indicates both the undesirability of this type of joint and also of single strap and lap joints.

Confining our attention, then, to double-strapped joints, further comment is required. We find that, for a given number of rows, those joints having all rows complete show the highest slip resistance (as might be expected, since they have the greatest number of rivets). Furthermore, we find that, while the slip resistance of the medium steel joints is generally consistent with the number of rivets, the high tensile steel joints show a very erratic performance, having in general about half or less of the resistance shown by the same type of joint in medium steel. When we note that the treble riveted joint in medium steel shows a beginning of slip at a stress of about 3 tons to the square inch and we realize that members so riveted are certainly subjected to such a stress or higher in ships' structures, and when we recall but relatively few instances of leaking in joints as compared with the frequency with which such critical stress must be exceeded, one is tempted to minimize the importance of the slip characteristics of joints developed in these tests. However, noting that the high tensile steel joints show inferior resistance to slip, and mindful that the premium on weight saving in future ship design will necessitate the acceptance of higher design stresses, and further, recognizing the permeating qualities of fuel oil as compared with water and the comparative difficulty of making such work satisfactorily tight, it is apparent that increasing importance attaches to the consideration of the slip resistance of a joint in those parts of the ship subjected to the highest stresses. The features of construction that give the best slip resistance are:

1. The use of joints in which all rows of rivets are complete.

2. The use of two-ply material where the highest stresses occur.

This feature is obtained in using two courses of plating for sheer strakes and main deck stringers, where one of the courses serves as one of the butt straps for joints in the other course. The presence of quilting rivets restrains relative motion between the two courses and thereby reduces slip—i.e., relative motion—at the joint.

3. The use of ample rivet area in the plate seams. The occurrence of slip in a joint throws a high concentration of stress into the adjacent strakes opposite the joint. If the plates of the strake containing the joint are connected to the adjacent strakes by ample rivet area, the slip that would otherwise occur will be restrained, and further, instead of a concentration of stress in the passing strakes opposite the joint, there will be a gradual distribution into the adjacent plates of so much of the load as could not otherwise be carried across the joint without slip.

4. The substitution of medium steel rivets for high tensile steel rivets in joining high tensile steel plates. Comparing the physical properties of the two steels, it would appear that four rows of medium steel rivets, for example, would have the same (or even greater) ultimate shear strength as three rows of high tensile steel rivets. It is, therefore, proposed in the case of high tensile steel that joints be designed to use medium steel rivets of an aggregate shearing strength in excess of the tensile strength of the plate. This proposition is made for the following reasons:

(*a*) The test results indicate a marked superiority in slip resistance (absolute superiority, and not relative after taking the material strength into consideration) where medium steel rivets are used.

(*b*) The superiority was indicated not only in the case when used with medium steel but was also apparent when used with special treatment steel.

(*c*) The causes for the poor performance of the high tensile steel joints can be corrected at least in part by the substitution of medium steel as a rivet material. These causes, which are threefold, are: first, the inherent difficulty of driving satisfactorily the hard nickel steel rivet as compared with the softer material, especially in the larger sizes; second, the fact that the high tensile steel plates are usually warped slightly as compared with medium steel, and cannot be brought into satisfactory frictional contact in driving up the hard rivet; and lastly, and perhaps most important,

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the difference in thermal characteristics of the two rivet materials.

(*d*) Medium steel rivets may be used without disadvantage with harder plates as it appears that the nature of the plate material has but little, if any, effect upon the rivet strength in shear.

From the standpoint of partition of load between the row of rivets, there is one observation of immediate practical application; namely, the fact that the disparity in load between the outer and inner row of rivets does not disappear in the double-riveted joint within the yield point of the material. This leads to the principle that important joints should always have at least three rows of rivets.

APPLICABILITY OF FOREGOING CONCLUSIONS TO RIVETED JOINTS IN GENERAL

The data obtained from the test joints, which were made from 30-pound plates with 20-pound cover plates, and 1-inch rivets spaced 4½ diameters apart, are satisfactory for drawing general conclusions as to the behavior of joints with other plate thicknesses and rivet diameters, since the conclusions rest upon fundamentals which are exemplified in the test joints. With regard to the factors derived for ultimate strength of joint, it is possible that the increase in plate strength for joints with all rows complete might be less with a wider rivet spacing, although the factor given (1.05) anticipates such reduction, this being the least gain observed (the maximum gain was 10 percent). The straps were relatively heavier in the test joints than required by the riveting specifications. The effect of using a lighter strap would be to reduce the proportion of load taken by the outer rivets and perhaps reduce the loss in strength observed in the joints having alternate rivets omitted in the outer rows. The factor given (0.93) is therefore on the safe side. The remaining conclusions and suggestions obviously may be made general in application.

The Absurdity of Fuel Oil as a Deck Coating

Analysis of a troublesome ship maintenance problem and reasons why crude oil is no deterrent to the corrosion of deck plating

By A. B. Newell

THE problem of keeping the decks of a steel freight ship coated with a suitable protection and preservative has been and probably always will be a difficult one because of the hard usage which they receive. Paint has been used with more or less unsatisfactory results for many years, but of late the application of fuel oil has been taken up by many owners apparently to their entire satisfaction, if without satisfactory preservation of the decks.

It has been reported by some ship masters that the use of fuel oil in place of paint is actually more harmful to the plates than leaving them bare. They are probably as wrong in this belief as is the popular fallacy that fuel oil is superior in any respect to paint, for although some fuel oils may contain certain elements, such as sulphur, which are harmful to steel in the presence of water, these are present in such small proportion as to have but little effect either one way or another. However, in choosing a paint for this purpose the bare thought of a harmful element contained therein would be sufficient to prevent its application. Unfortunately we are not so particular about the kind of fuel oil used for this purpose, the fact of its coming from the bunker tanks seeming to be sufficient guarantee as to its quality as a paint substitute.

USED FIRST ON FISHING VESSELS

As far as I am aware there is no authentic account of where the idea of using fuel oil for this purpose originated. However, I remember, a few years back, that in the port of Seattle, from which small fishing vessels of wood construction plied their trade, that their skippers discovered common bunker fuel, such as was used in steamers, to be a satisfactory substitute for coal tar and even better than pitch or asphalt while only second in value to linseed oil and pine tar, as a deck preservative.

The very quality which made it of value as a treatment for wood decks, on vessels in which appearance was counted as nothing and cleanliness as a secondary consideration, makes it undesirable for use on steel decks. This is its tendency to remain viscous under all conditions except the application of fire. It will not dry and continues to penetrate the wood with each repeated exposure to the sun until the rain and sea washes the surplus coating overboard. Steel though porous, to an extent which it is almost impossible to detect, will not absorb fuel oil, as is sometimes mistakenly believed. Such oil readily disintegrates and although adhesive will not set and remains a slippery greasy mass which, unless mixed with foreign substances to give it a substantial body, will give way to the slightest pressure. It does not become a homogeneous coating in any way integral with the metal. The slightest scratch will go beneath it while a deck that is awash for a day or two after it is applied will become so devastated of coating that it will begin to rust immediately thereafter.

The fact that it will penetrate paint work has no bearing, of a favorable nature, upon the subject. Paint when thoroughly dried is somewhat porous as the result of the evaporation of the volatile oils which are used as driers, while if not thoroughly dry, or if of such a nature as to remain in a very firm but plastic state, it will have at the surface, and throughout the mass, certain oils which have an affinity for fuel oil. Therefore the latter will either penetrate the pores of the paint or mix with the oils resulting in a discoloration of the surface. It may be removed with a caustic solution, the application of a scouring or abrasive substance or by the use of a secondary oil of a low viscosity or highly volatile nature such as kerosene or gasoline, which will penetrate and wash clean the pores or dissolve and remove the viscous coating. This will leave the under-coating ready for another application of paint.

LUBRICATING OILS TRIED OUT

Certain nicely compounded and quite expensive lubricating oils will preserve steel in the presence of water, but they have no wearing value, their important feature being the quality of lubrication. Such oils are not of purely mineral origin and are unlike fuel oils in this respect. However, we do have "slushing" compounds employed for the purpose of protecting machinery while in storage or transit,

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that resemble fuel oils in some respects, principally in viscosity and color. They are adhesive and become partly dry or set, after being applied and maintain a constant air- and water-tight seal as the result of their remaining in a semi-hardened and plastic state. Like the lubricating oils they have no wearing qualities of any consequence. Either of these would be superior to fuel oil as a deck coating.

Since fuel oils will not dry and form a solid, water resisting coat upon a steel deck they have but weak powers of resistance to the action of the elements. Generally after the first rain the oil becomes spattered over the bulwarks and runs down the ship's sides making great unsightly dark streaks, unless the hull is black. After heavy weather the inside of the bulwarks is badly smeared up with grease and dirt while the decks are as clean of oil as the day that the sailors finished scaling them. Fortunately the action of the sea generally carries it off the ship's sides as well as the deck and the crew have only to clean up the bulwarks and paint them over to get things looking shipshape and similar to their appearance before the decks were oiled.

Fuel Oil No Protection Against Corrosion

One of the finest examples of the action of crude oil, air and sea water is to be found in the cargo lines of a tank ship. After one of these vessels has finished discharging cargo sea water is pumped through the cargo lines to ballast her. The lower side of such pipes are invariably eaten through with corrosion long before the upper part of the pipe has suffered materially. This action is so pronounced that owners of such vessels frequently have the pipes turned bottom up after two or three years of service. That is, the pipes are given a half turn, thereby allowing the corrosive action to destroy the original top half of the pipe while the lower half still serves in a satisfactory manner, notwithstanding its weakened condition. If fuel or crude oil were a metal preservative, in the presence of sea water, these pipes would be very slow to become eaten away with corrosion. There is a slight erosive action at the same time which is the result of abrasives such as rust and scale sweeping along the bottom of the pipe with the liquid, but an observation of such pipes after their removal reveals that the corrosive action has been much more severe than that of erosion.

On some ships upon which fuel oil is used as a deck coating the results are somewhat more satisfactory than upon others. If they are thus coated and immediately thereafter the ship loads coal, the dust in settling over the oil will make a thoroughly gummy and sticky mass which can only be removed by a good storm at sea. Discharging leaking bags of portland cement on a breezy day and having it scattered over the fuel oil in this way has been known to so please the mate that he later tried mixing the fuel oil with cement in an attempt to make the coating permanent. Any form of dust if applied in sufficient quantity will help to prevent the oil from being tracked away.

If what I say is true—and it is—the question naturally arises as to why fuel oil is so commonly used. I do not believe that owners are fully cognizant of the facts, although some have themselves to blame for not knowing.

On one ship the mate oiled the decks once a month and scaled them of rust three times a year. Prior to this he had painted them every month and scaled about two-thirds of the surface once a year. A liberal use of paint I grant. The captain reported to the manager that the decks were deteriorating three times as rapidly with the use of fuel oil as they had when kept painted. The manager did not believe it. But there were many things he did not believe. The same captain sent a wireless report of the time of arrival and the manager did not believe it and made no arrangements to receive the ship. He said frankly that the joke was on him. His estimate was that the ship was three hundred and fifty miles farther away than the captain's report stated. Did not think the skipper knew where he was. Liberal in most other respects he had this misconception of saving on the cost of deck maintenance. When he was shown a section of deck that was painted once and not scaled, yet in better condition than the rest that had been scaled three times and oiled twelve he said. "You don't put on enough oil."

I asked the captain of one ship why he did not report the action of crude oil to the owners and he replied, "Let someone else do it. Decks are of little consequence in any case and nothing will stay on them."

A third one lay the blame on the port captain who it seems was trying to materially reduce the paint bills for the fleet.

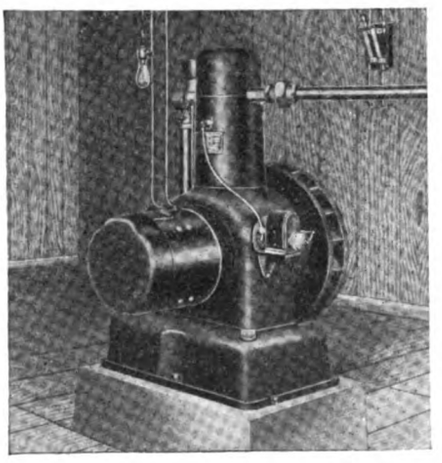
The fourth one whom I approached on the subject believed in using crude oil on the decks, notwithstanding the fact that about the only place he had managed to make it stick and never move was in the carpet of his room.

Ships are generally "dressed up" before coming to the home port. The owner visits them. The paint work is in nice shape, clean and fresh. The decks are nicely smeared with oil and everything looks spick and span and but few of them really know how the work of maintenance is subdivided at sea. That is the percentage of time spent on decks, cabins, hull, etc.

If this idea of oil as a metal preservative is sound as applied to the most difficult part of the ship to maintain why not try it on the hull? A capital idea that. Let's try painting the ship's sides with it.

New Westinghouse Light and Power Plant

A new non-battery design of light and power plant is being manufactured by the Westinghouse Electric and Manufacturing Company for furnishing light and power on ships. It is also valuable for auxiliary electric service and for standby service.



New Westinghouse type E-86 light and power plant

This new type of plant, type E-86, is a non-battery, 2,000 watt, 110 volt plant, particularly adaptable where the use of batteries is not desirable. The new plant will develop 4 kilowatt hours of power on one gallon of fuel. It is air cooled, lubricated with the splash system and no electrical parts are exposed. This plant has a shipping weight of 695 pounds.

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Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Relation Between Piston Speed and Steam Pressure

Q. (1,365).—Please advise how to determine steam engine piston speed in relation to steam pressure. Assuming a triple expansion engine with initial steam pressure of 180 pounds has a speed of 110 revolutions per minute, what would be the revolutions when the pressure fell back to 130 pounds per square inch?

A. (1,365).—The relation between chest pressure and revolutions per minute may be found approximately by the use of the following table based on percentage of full power conditions:

Percent of Full Power Chest Pressure	Percent of Full Power Revolutions
30	43
40	55
50	64.5
60	72.5
70	80.5
80	87.5
90	93.5
100	100

If these figures are plotted, a fair curve will result from which the revolutions per minute may be found for any reduction in chest pressure.

$$\text{Reduced pressure in percent of original pressure} = \frac{130}{180} = 72.2$$

Reduced revolutions per minute in percent of original revolutions per minute = 81

Revolutions per minute corresponding to 130 pounds pressure = 110 x 0.81 = 89.1

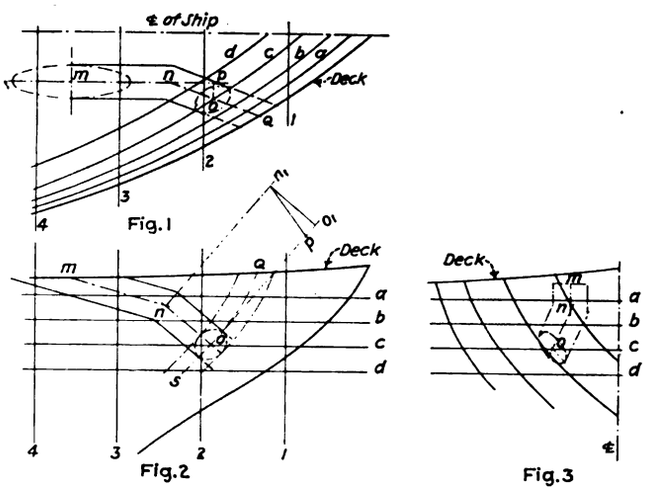
How to Find True Length of Hawse Pipe

Q. (1,367).—Please give a method for developing and finding the true length for a hawse pipe of the type fitted on battleships and cruisers. I would also appreciate the names of any text books having matter on this subject.

A. (1,367).—It is assumed that by "true length" you mean the length measured along the center line of the hawse pipe. A distinguishing feature of the after hawse pipes in our modern battleships is the curved or bent axis introduced to assist in guiding the anchor into stowage position. In Figs. 1, 2 and 3 are shown in outline the plan, elevation and end view of a battleship bow with the after hawse pipe. For convenience the deck is drawn without camber. Water or level lines a, b, c and d are indicated, and stations 1, 2, 3 and 4. The axis of the hawse pipe is m n o, the change in direction taking place at n. Lines m n and n o have been assumed straight lines, the former parallel to the longitudinal, vertical plane at the vessel's center line. Therefore, m n appears at its true length in Fig. 2.

The point o is that at which the axis of the hawse pipe intersects the surface of the ship. It is determined by passing a vertical plane through line n o. This plane intersects the surface of the ship in the curved line q s. The point o is common to both n o and q s and marks the end of n o.

The line n o is inclined to a vertical plane passing through m n and the point o is distant from this plane by an amount o p. In order to avoid confusion, n o has been



Graphical method of determining the true length of a hawse pipe

transferred parallel to itself to n_1 o_1 and the distance o_1 p laid off equal to o p. Then the true length of n o is shown by n_1 p and the total length of the axis of the hawse pipe is mn + n_1 p.

If the line m n were inclined to the central longitudinal vertical plane, a correction similar to that shown for n o at n_1 o_1 p would be required.

If the shape of the opening in the deck or shell is required, it becomes the problem of the intersection of a cylinder with a curved surface.

In the case of an actual hawse pipe, there would probably be a radius at n rather than the intersection shown. This involves no change in the principles outlined above provided the radius is small.

However, if the diameter of the hawse pipe is large relative to its length and it has a pronounced bell mouth as is frequently used with the stockless anchor, the correct shape and length are obtained by "mocking up."

"Laying Off or The Geometry of Shipbuilding" by Edward L. Atwood and I. C. G. Cooper, published by Longmans, Green & Company, New York, is valuable for reference purposes.

Water Evaporated Per Pound of Fuel

Q. (1,368).—With reference to the number of pounds of water evaporated per pound of fuel burned, please let me know if there is any way this can be found on board ship, in actual service, without the use of special tanks, scales, etc. Would it be possible to obtain accurate results merely by measuring the quantity of water fed through the filter box, to find the feed pump slip and consequently the amount of water fed into the three boilers;

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and by finding the fuel consumed by reading a meter installed on the fuel oil suction line? It is known that the fuel meter overruns by about 6 percent for extended periods, but nothing is known of its error for short periods, say one or two days.

A. (1,368).—A rough estimate of the amount of water fed to the boilers per hour may be made by counting the number of pump double strokes per minute and assuming a pump volumetric efficiency of about 85 percent. It is understood that there are fuel oil meters on the market giving accurate results within 2 percent. Six percent seems somewhat excessive.

Another method for estimating the amount of water evaporated per pound of fuel would be to measure the fuel by meter, reduce this value to fuel per square foot of heating surface, then, knowing the feed temperature and boiler pressure, the factor of evaporation may be calculated. Now by the use of a trial performance curve plotted on fuel per square foot of heating surface per hour and pounds of water evaporated per pound of fuel per hour from and at 212 degrees F., the "from and at" water may be determined. This value divided by the factor of evaporation gives the actual water evaporated per pound of fuel.

It might be possible to supply you with a curve such as that referred to above should you desire it, provided the type of boiler comes within the writer's available data.

PERSONAL MENTION

THOMAS A. LAUGHLIN has been appointed Lloyd's agent at San Francisco, Cal., to succeed the late Captain W. R. Kennedy.

E. H. EWERTZ, general manager of the Moore Plant of the Bethlehem Steel Corporation, Ltd., has tendered his resignation to take effect June 1, 1927.

HARLEY E. PIPPIN has been appointed general agent of the Matson Navigation Company in New York. Mr. Pippin plans to take up his duties in February.

ROLAND K. SMITH, appointed by the President to fill a vacancy in the Shipping Board, was confirmed as a member of the Shipping Board by the Senate on December 17.

A. WESLEY BARTHELMES has been appointed manager of the inland marine department at the home office of the American Fore Companies in New York, succeeding R. C. Walsh, who resigned recently.

A. B. HOMER has been appointed manager of sales for east coast plants of the Bethlehem Shipbuilding Corporation and is in charge of the New York office. Mr. Homer assumed his new duties on December 1, 1926.

DR. R. S. MACELWEE, commissioner of Port Development for the city of Charleston, S. C., has been appointed engineering editor for the marine publication *Port and Terminal,* succeeding the late H. McL. Harding.

EDWARD P. FARLEY, a former chairman of the Shipping Board, has been elected a member of the board of directors of the American-Hawaiian Steamship Company (San Francisco, Cal.) and a member of the executive committee.

HENRY P. WRIGHT, for the past four years general manager of the Washington district for the Emergency Fleet Corporation, has resigned to open on January 1 the offices of the Henry P. Wright Company, steamship and tourist agency.

W. C. STRUNK, who has been in charge of stoker negotiation work at the South Philadelphia works of the Westinghouse Company, was recently appointed stoker specialist in the New York district, succeeding E. R. Stone who was recently appointed manager of stoker sales.

OWEN A. SMYTH has been appointed passenger traffic manager of the United States Lines, New York; Addison G. Foster has been appointed assistant passenger traffic manager. Both appointees have had wide experience in handling steamship passenger traffic and both have been connected with the United States Lines since its inception.

CAPTAIN W. J. STOFEN, manager at Los Angeles harbor for the General Steamship Corporation, has resigned to go into business for himself. He has joined forces with Captain C. B. McMullen, marine surveyor. The name of the firm is McMullen and Stofen, marine surveyors. Mr. Stofen is succeeded by H. H. Birkholm, former operating manager at San Francisco.

GEORGE KOETTER has been appointed operating manager in charge of all ship and terminal operations of the United American Lines, 39 Broadway, New York, general agents in this country for the Hamburg-American Line. Mr. Koetter succeeds H. R., Hanlin, who has been appointed president of the Mercur Trading Corporation, 15 Whitehall street, New York. The offices of Mr. Koetter will be located at Pier 86, North River.

W. B. KEENE has been appointed vice president of the Munson Steamship Line, New York. Mr. Keene is well known in the shipping world, having been in the transportation business since 1905. Prior to joining the Shipping Board in 1918, he was vice president of the Savannah-New York Transportation Company. He joined the Shipping Board as freight traffic manager and was later promoted to vice president in charge of traffic for the Fleet Corporation, a post he held until last summer, when he resigned.

CHARLES M. SCHWAB, chairman of the Bethlehem Steel Corporation, Bethlehem, Pa., was elected president of the American Society of Mechanical Engineers at the 47th annual meeting held this week in New York, succeeding William L. Abbott, who retired. Besides Mr. Schwab, the following officers were also elected: Vice presidents, Charles L. Newcomb, Springfield, Mass.; Professor Everett C. Eastwood, University of Washington, Seattle, Wash.; Edwards R. Fish, St. Louis, Mo. Managers, Paul Doty, St. Paul, Minn.; Ralph E. Flanders, Springfield, Vt.; C. N. Lauer, Philadelphia, Pa. Treasurer, Erik Oberg of New York.

A. C. HARDY, who became editor of MOTORSHIP, New York, on January 1, served a five years' apprenticeship with Palmer's Shipbuilding and Iron Company at Jarrow-on-Tyne, prior to taking the course in naval architecture at Armstrong College, Newcastle, England. After graduating he was engaged for a time in the office of a consulting marine engineer and naval architect and then joined the staff of the *Marine Engineer* and of *Shipbuilding and Shipping Record* in London. Mr. Hardy is the author of "Motorships," "Merchant Ship Types," "Bulk Cargoes" and "From Slip to Sea" and has contributed several papers before technical societies. He is a member of several technical societies and institutions and is a Fellow of the Royal Geographical Society in London.

DR. F. A. KOLSTER, whose latest radio invention to prevent collisions between vessels in a fog is described on page 31 of this issue, has become distinguished in the development of radio during the last 25 years. He invented the radio compass, the decremeter for measuring wave lengths and the radio fog signal. The small rotating loop now used on broadcast receivers originated in his radio

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compass as a direction finder. In 1912, while in charge of radio in the Bureau of Standards, he was appointed technical advisor to the American delegation at the International Radio Convention in London. At present he is in charge of the research laboratories of the Federal Telegraph Company at Palo Alto, Cal.

LIEUTENANT COMMANDER EDWARD ELLSBERG (CC), U. S. N., has tendered his resignation which has been accepted by the Secretary of the Navy. When his resignation was forwarded to the Secretary, Rear Admiral John D. Beuret, chief of the Bureau of Construction and Repair, stated: "The bureau regrets that the Navy will lose the services of an officer of Commander Ellsberg's ability but recommends that his resignation be accepted unless such action is contrary to the department's general policy." Lieutenant Commander Ellsberg, who was on duty at the Navy Yard, Brooklyn, New York, at the time of his resignation, was recently awarded the Distinguished Service Medal for his performance of duty in connection with the raising of the submarine *S-51*. He graduated from the Naval Academy at Annapolis June 5, 1914, as the honor man of his class and entered the construction corps of the Navy, July 26, 1917.

LORD KYLSANT of Carmarthen, Wales, chairman and managing director of the Royal Mail Steam Packet Company, by virtue of the recent purchase of the White Star Line from the International Mercantile Marine Company has become the world's greatest shipping operator. The fleet coming under his direction includes 538 first class vessels owned by the Royal Mail and the Castle Line, of which he is also chairman. The shipbuilding firm of Harland and Wolff, Ltd., comes under his direction as well. Born in March, 1863, and christened Owen Cosby Philipps, he was the third son of the Reverend Canon Sir James Erasmus Philipps, prebendary of Salisbury Cathedral. His father was the twelfth baronet of the Philipps Line, a distinguished family in Wales and one which has been a factor in Carmarthenshire for many centuries. Lord Kylsant was educated at Newton College in South Devon where he studied engineering and economic subjects. In 1889 he began his career in maritime affairs by becoming the owner of one steamship. His rise as a factor in the marine industry was rapid and in 1902 Owen Cosby Philipps, as he was then, became chairman of the Royal Mail Steam Packet Company. The keynote of his whole career had been to keep abreast of the times and then a few decades ahead of them. He has been characterized as a "smoothly running human dynamo, almost silent, often invisible in the very places which thrill with the activities he sets in motion." In addition to his duties as chairman of the Royal Mail, Castle Line and the firm of Harland and Wolff, he is a business director in 40 companies and organizations in all. Among the positions he holds are the presidency of the British Mail Council of Congress, director of the Southern Railway, past president of the London Chamber of Commerce and past president of the Chamber of Shipping of the United Kingdom. Although a yachtsman, he tends more during his hours of relaxation to country life. In his native Wales he owns some 5,000 acres and takes a keen delight in being Lord Manor of Llanstephan and Master of Foxhounds. His principal seat is Amroth Castle, although he has several other residences.

Lord Kylsant

JOHN F. METTEN, for a number of years chief engineer of William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa., was elected vice president of the company at a recent meeting of the board of directors. His career in the shipbuilding industry had its beginning at the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., where he served as a draftsman in the engineering department. About 1900 he transferred his activities to the Cramp shipyard where he rapidly rose to the position of chief draftsman and subsequently to that of chief engineer. It is understood that Mr. Metten will retain this office together with his new duties as vice president.

J. F. Metten

OBITUARY

W. A. POWELL, head of the Powell Transportation Company of Mobile, Ala., died recently at that place. Mr. Powell was 51 years of age.

JAMES SHEWAN, of the ship repair firm of James Shewan and Sons, Inc., 32 Broadway, New York, died on Sunday, December 12, at his home, 630 Park Avenue, New York. Mr. Shewan was 55 years of age.

S. I. CARPENTER, for over 25 years New England advertising representative of MARINE ENGINEERING AND SHIPPING AGE, died on December 24 at his home in Sharon, Mass., from a stroke of apoplexy. Mr. Carpenter was 70 years old.

CAPTAIN LUTHER B. DOW, secretary-treasurer of the American Steamship Licensed Officers' Association, died suddenly on Saturday, November 20, 1926. Captain Dow was born in Portland, Me., September 20, 1854, and followed the sea for many years as an officer in both sail and steam.

LAWRENCE MACMURTRIE, well known on the Atlantic and Pacific coasts and on the Great Lakes as a shipbuilder, died recently at the home of his daughter in Duluth, Minn. Mr. MacMurtrie was born in Scotland and served his apprenticeship in shipbuilding in that country, coming to the United States when he was 21. He was naval architect of the Maryland Steel Company's shipyard at Baltimore (now Sparrows Point plant of the Bethlehem Steel Company) at the time the yard was established. Later Mr. MacMurtrie was associated with Moran Bros. at Seattle, Wash.; and with the sugar manufacturing machinery industry in Porto Rico. During the war, Mr. McMurtrie was senior inspector for the Shipping Board at Duluth, Minn., and retired after the government shipbuilding program was completed.

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The Month's Shipping and Shipbuilding News in Brief

Shipyard, Steamship and Port Activities and Other Notes of Interest in All Branches of the Marine Industries

Specifications Being Prepared for Three Fireboats for Portland

PLANS and specifications are now being prepared for the construction of three new steel fireboats for the city of Portland, Oregon. They are to be either Diesel or gasoline driven and will cost close to $750,000 for the three boats. Bids are to be called early in 1927.

Plans Completed for Standard Oil Co. of Indiana Tanker

INFORMATION has been received that plans and specifications have now been completed by the Standard Oil Company of Indiana for the construction of one or two 360-foot tank ships for service on the Great Lakes. It is understood that the vessels will be constructed at Great Lakes shipyards. Further details will be available shortly.

Cities Service Company Proposal to Build 13,000 Ton Tanker Active

THE Cities Service Company, New York, has been asking proposals from the shipbuilders in the last few weeks for designs and estimates on the construction of a 13,000-deadweight ton, reciprocating engine-drive tanker. Although no decision has as yet been reached in the matter, it is believed that an order for such a tanker will be placed within a short time by this company.

New York Central R. R. and Long Island R. R. Contemplate New Diesel Electric Tugboats

INFORMATION has been received at this office that the New York Central Railroad may soon be in the market for one or two Diesel-electric tugboats. Although no details of these boats are as yet available, it is believed that they will be the largest tugboats of this type so far built, the propelling motors being more powerful than those of the electric ferryboats now being operated on the North River by the Electric Ferries, Inc., New York. These ferryboats are each equipped with two 350-brake horsepower main engines, while the main propelling motor delivers 580 shaft horsepower.

It is further understood that the Long Island Railroad Company will also build one Diesel-electric tugboat of a similar type. Plans and specifications for both the New York Central and Long Island tugboats should be available in about a month's time.

Two Diesel Tankers Estimated on by Atlantic Coast Yards

A REPORT has been received at this office that bids were received from several shipyards during December for the construction of two Diesel drive tankers. Although the principals in the matter are not known and the details are not available at this time, it is understood that one vessel is to have 15,000 tons deadweight capacity, while the second ship will be of 10,000 tons deadweight. So far no decision has been reached on the award of these tankers. It is believed that the tankers may be for one of the South American Republics, as fleet auxiliaries.

Report Current That Sun Shipyard Will Build Diesel Tanker for the Sun Oil Company

REPORTS have been current during the past month that the Sun Shipbuilding and Drydock Company, Chester, Pa., in the near future will build a Diesel tanker for the Sun Oil Company, Philadelphia. It is believed that the keel for this vessel will be laid down some time in February. Although no detailed information is as yet available giving the characteristics of the ship, it is understood that she will be of about 15,000 tons deadweight carrying capacity. Power will probably be supplied by two 2,500-horsepower opposed piston type Sun-Doxford oil engines, which will give the ship a speed of between 14 and 15 knots.

Coast Guard Asks Bids on Machinery for Three Cutters, January 25, 1927

SEALED proposals will be received by the Treasury Department, United States Coast Guard, Washington, D. C., until 2:00 P. M., January 25, 1927, and then publicly opened, for three turbo-electric ship propulsion sets, and other electrical and miscellaneous equipment for the Coast Guard cutters *Nos. 45, 46,* and *47.* The $1,000,000, which the director of the budget approved this year of the $9,000,000 appropriated by Congress for the construction of 10 new Coast Guard cutters, will be used toward the construction of these three vessels. These cutters are to be built at a cost not to exceed $900,000 each.

After the contracts for the machinery are awarded, bids for the construction of the hulls will be invited. The three new vessels will be of the same design, the tonnage of each being about 1,800 or 1,900 tons and the speed about 16½ knots. It is expected that one or more of the vessels will be built on the Pacific coast since it is understood that at least three of the new cutters will be allocated to service on this Coast.

Panama Canal Commission Issues Specifications for Diesel-Electric Suction Dredge

SEALED proposals will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., not later than 10:30 o'clock, January 12, 1927 and then publicly opened, for furnishing by steamer, free of all charges, on dock at either Cristobal (Atlantic port) or Balboa (Pacific port) Canal Zone, Isthmus of Panama, one 24-inch Diesel-electric suction dredge complete in every respect, with the exception of crew's quarters.

The dredge is designed for operation in the Panama Canal or adjacent waters, either fresh or salt water. It is to be of the hydraulic type with one 24-inch pumping unit, electrically driven, the prime movers of the power plant being Diesel engines of approved type. The dredge output is to be 2,200 cubic feet per minute of a mixture of water and solids, with the average density of 75 pounds per cubic foot. The maximum depth allowed under full load conditions will be 15 feet and the minimum freeboard with the dredge in full load working condition will be not less than 4 feet 6 inches.

The main pump will be a centrifugal single suction pump, with a 25-inch diameter suction, 24-inch diameter discharge, with discharge at bottom. The main power plant will consist of four Diesel-engine generating sets, three of which must be capable of furnishing all power for a normal full load operation of the dredge, the fourth serving as a standby. Each Diesel generating set will consist of an engine, a main generator and an auxiliary generator (exciter). Each generating unit, consisting of generator and exciter, is to be driven by a marine type nonreversible Diesel engine, with a piston speed of 950 feet per minute, mean indicated pressure, four-cycle, 90 pounds per square inch and mean indicated pressure, two-cycle at 80 pounds per square inch.

The following auxiliaries for the main propulsion machinery will be installed:

One combined generating and air compressor unit; one auxiliary motor-driven air compressor; one motor-driven fire pump, with capacity of 800 gallons per minute at 100 pounds pressure; two motor-driven bilge and circulating pumps, plunger type, each of which is to have a capacity equal to the circulation water requirement of two Diesel engines and be able to operate against a head of at least 15 feet; two motor-driven centrifugal pumps, each 100 gallons per minute capacity at 50 foot head; two motor-driven water service pumps, each of sufficient capacity to supply all necessary water service to bearings, glands, etc., and one motor-driven rotary fuel oil transfer pump (bidder to state head).

All pumps are to be of the centrifugal type designed for marine use, except the circulating pump and the fuel pump. In all cases where duplicate pumps are

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furnished for the same service, each will be installed in a separate watertight compartment from its corresponding pump, to avoid both being out of service at the same time. Additional details may be obtained on application.

U. S. Engineer Office at Mobile to Open Diesel Electric Tug Boat Bids February 7

OFFICIAL information has been received that the date for the receipt of bids for the construction of a steel Diesel-electric harbor tug for the United States Engineer Office, Mobile, Ala., has been set for February 7, 1927. The tug is to have a length between perpendiculars 97 feet; length overall, 101 feet 13/16-inch; breadth, molded, 22 feet; depth at side, molded, 10 feet 6 inches; depth at center line, molded, 10 feet 11½ inches; sheer forward at center line, molded, 4 feet ½ inch; and camber in 22 feet, molded, 5½ inches.

Two Diesel engines of not less than 250 brake horsepower each are to be installed. They are to be of the 4-cycle air, 4-cycle solid or 2-cycle air injection, vertical, multi-cylinder type and the product of an American firm regularly engaged in the manufacture of Diesel engines. Each engine will be direct connected to a 160-kilowatt generator of the open type, shunt wound, designed for 125 volts direct current and to be separately excited at 115 volts. The exciters consist of two 15-kilowatt machines of the semi-enclosed, 115-volt, direct current compound wound type, which are also direct connected to the main engines and generators. The propelling motor is of the open type, shunt wound, and capable of delivering 400 horsepower continuously at any speed between 160 and 230 revolutions per minute. The control of the propulsion motor is of the variable voltage system with operation stages located in the engine room and in the pilot house.

Coast Guard patrol boat Harriet Lane, one of six launched by the American Brown Boveri Electric Corporation, Camden, N. J., on November 30

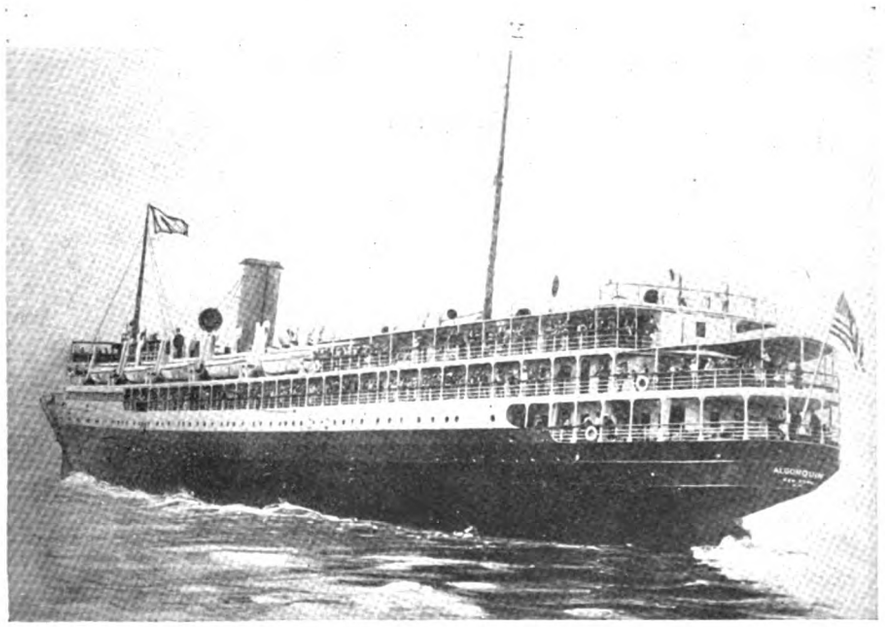
Seagoing Tug Added to Salvage Process Corporation Fleet

THE installation of equipment under the Wheeler system for pumping oil, sludge, gases and other substances from tanks, double bottoms, bilges and other receptacles was recently completed on the seagoing tug *H. J. Wheeler* for the Salvage Process Corporation, New York. The *H. J. Wheeler,* formerly the *Light Horse,* was built in 1919 at the Fore River, Mass., yard of the Bethlehem Shipbuilding Corporation, Ltd. She has a length of 147 feet, a beam of 31 feet, a gross tonnage of 421 and a net tonnage of 223. Steam is supplied by two Scotch boilers equipped with the Coen fuel oil burning system.

Until the addition of this new tug the fleet of the Salvage Process Corporation consisted of one tug and three barges each equipped with one suction line. The new unit is fitted with a powerful vacuum pump and two suction lines thus increasing the pumping capacity of the fleet by more than one-third of its former capacity.

City of Seattle Asks Bids on New Fireboat

BIDS for the construction of an additional fireboat for the city of Seattle will be received and opened by C. B. Bagley, secretary of the Board of Public Works, Seattle, Wash., on January 14, 1927. The new vessel is to have a length overall 123 feet 6 inches, length between perpendiculars 118 feet, beam 26 feet, draft 7 feet 6 inches and is to be of steel construction. She is to be equipped with triple screw gasoline engines, giving the ship a speed of 14 knots. Six four-stage centrifugal pumps are also to be installed, having a total capacity of 12,000 gallons per minute at a working pressure of 200 pounds.



New Clyde liner Algonquin leaving New York on her maiden voyage to Miami on December 15 with full passenger list

Bids Aked for Construction of Diesel Towboat

SEALED proposals will be received by the United States Engineer Office, St. Louis, Missouri, until January 20, and then opened, for the construction of one 110-foot steel hull Diesel towboat. The vessel is to have a length overall 131 feet 5/8-inch; length, molded, 110 feet; breadth, molded, 23 feet; depth, 5 feet; camber, 4 inches; mean draft, loaded, with full supply of fuel, water, supplies and equipment, 3 feet 6 inches; sheer, forward, 2 feet 6 inches, and sheer, aft at sides, 1 foot 6 inches.

The boat is to be equipped with one 300-brake horsepower vertical, multi-cylinder, two or four stroke cycle, air injection Diesel type engine, arranged for electric drive. It is to be the product of an American firm, regularly engaged in the manufacture of Diesel engines.

One horizontal, duplex, motor driven double acting piston pump, Worthington Pump and Machinery Corporation, or equal, with motor mounted on top of frame and with intermediate gear and raw hide pinion for connecting motor to the pump is to be installed. A horizontal double acting piston pump, Deming Company, Salem, Ohio, type "BA", or equal, fresh water pump, motor and control, similar to the sanitary pump installation, and a rotary fuel oil pump, Northern Fire Apparatus Company, or equal, are also to be installed.

The propelling motor is to be of the open type, reversible, shunt-wound, designed for 230 volts direct current, capable of delivering 225 horsepower continuously, at all speeds between 360 and 600 revolutions per

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minute. The capstan and motor is to be furnished and installed by the contracting officer. The vessel and equipment, unless otherwise specified, are to be built to the Rules of the American Bureau of Shipping. Additional information may be obtained on application.

Communication System on New Merchants & Miners Liners

ONE of the features of equipment on the three ships of the Merchants and Miners Transportation Company, New York, the *Chatham, Dorchester* and *Fairfax,* which were recently completed at the yards of the Newport News Shipbuilding and Dry Dock Company, is the telephone system between the staterooms and the steward's office which was installed by Chas. Cory & Son, Inc., New York. The usual call bell system has been eliminated and a complete telephone installation with a central operator fitted. The telephone itself is of the European type hand set which is better adapted for ship installation than the conventional wall box type applied against the bulkhead.

In addition to the telephone system, Chas. Cory & Son, Inc. has furnished the equipment for the installation of mechanical engine docking and steering telegraphs, navigating telephones, electro-pneumatic fire alarm systems, electric whistle valves and controls as well as a great number of miscellaneous incidental equipment.

Contract for Los Angeles Fireboat Awarded to Los Angeles Yard

A CONTRACT for the construction of the Los Angeles fireboat *No. 2* has been awarded by Ralph J. Scott, chief engineer of the Los Angeles Fire Department, to the Los Angeles Shipbuilding and Drydock Company, San Pedro, Cal., at a price of $214,000. The hull of the new vessel is to be constructed of steel throughout, with the exception of wood fenders. The principal dimensions are as follows: Length overall 99 feet; length between perpendiculars 93 feet 4 inches; beam, molded, 19 feet; beam over guards 20 feet 4½ inches; depth, molded, 9 feet 7 inches, and draft, mean, 6 feet 6 inches. The hull is to be subdivided by three transverse bulkheads forming a forepeak forward, a machinery compartment and an after peak, all bulkheads extending to main deck, which is of steel. The deckhouse contains raised pilot house, nozzle and equipment room, galley and toilet.

The fire fighting equipment comprises five monitor turret nozzles, one located on main deck forward, one on top of pilot house, two on the main deck aft and one on top of the electrically operated telescopic water tower, having a maximum elevation of 44 feet above the waterline; each monitor nozzle is capable of delivering 3,000 gallons of water per minute.

The power plant consists of seven Winton gasoline engines, each of 300 horsepower and two Winton engines, each of 25 horsepower. One engine drives the center propeller only. Two engines drive the side propellers or pumps through clutch. Four engines drive the pumps only, and the small engines drive the electric generators. The boat will have a speed of 17 miles, with three engines operating. The pumping equipment consists of six 8-inch four-stage multiplex type pumps.

Sun Company to Recondition Dredge

THE dredge *New Orleans* has been drydocked for reconditioning at the plant of the Sun Shipbuilding and Drydock Company, Chester, Pa. The vessel has been out of commission for some time at the Fort Mifflin base of the army engineers. The price involved for the work was not made public.

New London Ship Company Gets Contract for Two Peruvian Submarines

A CONTRACT for the construction of two 600-ton submarines has been awarded to the New London Ship and Engine Company, Groton, Conn., a subsidiary of the Electric Boat Company, New York, by the Peruvian government. The vessels are to be named *R*-3 and *R*-4 and will be similar in most respects to the Peruvian submarines *R*-1 and *R*-2, recently completed at the same plant. The contract price was not made public.

Electric Motor Contracts Placed for Two Scout Cruisers

THE Electro Dynamic Company, designers and builders of alternating and direct current motors and generators, Bayonne, N. J., have been awarded a contract from the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for the construction of 68 motor driven auxiliaries for the complete turret ordnance requirement on scout cruisers *Nos. 24* and *25* (United States steamships *Pensacola* and *Salt Lake City*), at a price of $44,083.85. The auxiliaries include 16 powder hoists, 8 training gears, 8 elevating gears (all twin and triple mounts), 20 rammers and 16 ventilating sets.

This is the first electrical contract that has been placed on these two new 10,000-ton treaty cruisers.

Passenger Ship Panama to Be Conditioned and Fitted to Burn Oil

THE 5,665-gross ton passenger liner *Panama* was recently purchased by the Alaska Steamship Company, Seattle, Wash., from the Panama Railroad Company, New York. The vessel has been lying idle in Lake Gatun. She is to be drydocked in Balboa for final inspection before being taken over by the Alaska Steamship Company. Upon her arrival in Seattle, the *Panama* will be changed from a coal to an oil burner, given an Alaskan name and converted into a sister-ship of the *Yukon,* which is capable of carrying a total of 428 passengers. The *Yukon* also was purchased from the Panama Railroad Company and formerly was known as the *Colon.* The two ships operated between New York and Panama as passenger-cargo carriers. The purchase price of the *Panama* was not made public.

The *Panama* is 360 feet long, 50 feet beam and 32.2 feet deep. She is a twin-screw steamship and was built in the William Cramp and Son Ship and Engine Building Company yards in Philadelphia.

Bids Opened for Construction of Ferryboat for Army Engineers

THE ferryboat *General Hancock,* which has been operated for the past 25 years between Governors' Island and the Battery, is to be replaced by the ferryboat *General Otis.* The *General Hancock* was built by Pusey and Jones in 1898.

Bids for the construction of a new ferryboat for this run were received and opened by the United States Army Engineers, Washington, D. C., on Tuesday, December 14. A decision on the award of this contract has not as yet been reached.

Disposition of I. M. M. Fleet

THE Royal Mail Steam Packet Company, with New York offices at 26 Broadway, has purchased the Oceanic Steam Navigation Company, Ltd. (White Star Line), from the International Mercantile Marine Company, 1 Broadway, New York. The transfer of the fleet will take effect on January 1, 1927. The price at which the deal was concluded is reported to have been £7,500,000. The White Star Line totals 40 vessels, aggregating approximately 500,000 tons and includes such steamships as the *Olympic, Homeric* and the *Majestic.* Most of the fleet was built by Harland and Wolff of Belfast, of which Lord Kylsant is chairman.

Information has also been received that the International Mercantile Marine will soon enter into negotiations with other British interests for the sale of the Leyland Line and possibly the Atlantic Transport Line, Ltd.

Warning

THE trade is hereby warned to be on the lookout for one Charles Judson Feldmiller or Miller representing himself to be an agent of either King Knight Company of San Francisco, California, or of the New London Ship & Engine Company of New London, Conn. This man is wanted in San Francisco for passing worthless checks and for obtaining money under false pretenses. He is 6 feet 3 inches in height, weighs 212 pounds, has black hair, combed straight back, is dark-complexioned, and has a bald spot on right side of head over which he combs his hair; was dressed in a dark-blue suit with lighter stripes and a grey-blue overcoat which he obtained fraudulently; these were made by the firm of "Hing Chong and Company," Chinese tailors of 525 Kearny Street, San Francisco, California. Anyone knowing this man's whereabouts, please communicate with Mr. Arthur J. Holton, care of Mercantile Trust Company, 464 California Street, San Francisco, California.

Atlantic Refining Company to Equip Motor Launches with Diesel Engines

IT is understood that the Atlantic Refining Company, Philadelphia, Pa., will shortly re-engine a number of motor launches used in harbor service. At the present time, these boats are equipped with engines of about 75 horsepower. The new engines to be installed will be of approximately 150 horsepower and will be of the Diesel type.

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Clyde Line S.S. Iroquois Launched

THE Clyde Line, New York, launched its fifth new passenger vessel, the liner *Iroquois,* on Saturday, December 11, at the yards of the Newport News Shipbuilding and Drydock Company, Newport News, Virginia. The addition of the *Iroquois* is part of the Clyde Line's building program of six vessels representing a total value of $14,000,000, for its New York-Miami, Fla., service.

Fletcher Yard to Carry Out Repairs to Liner George Washington

A CONTRACT for annual layup repairs to the United States steamship *George Washington* has been awarded to the W. and A. Fletcher Company, Hoboken, N. J., at a price of $96.960. The other bids received for the work were:

Tietjen and Lang Drydock Co. ...$100,686
Morse Drydock and Repair Co. ... 106,878

I. P. Morris Corporation Separated from Cramp Company

PLANS for the segregation of the I. P. Morris department of the William Cramp and Sons Ship and Engine Building Company, Philadelphia, Pa., were recently prepared. This department, which is understood to be the most profitable unit, will be organized into the I. P. Morris Corporation and a holding company will be formed to take over the subsidiary corporation of the Cramp company. The I. P. Morris Corporation is engaged in the construction of machinery for hydro-electric developments in this and foreign countries.

Barge Contract Awarded to Los Angeles Shipyard

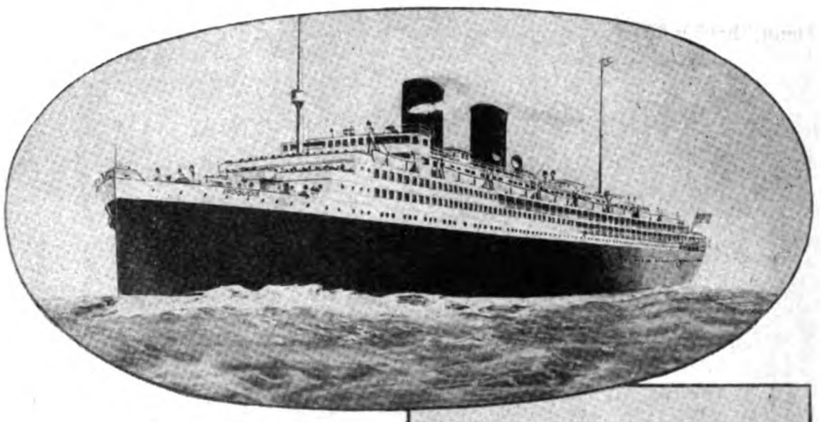
A CONTRACT for the construction of a steel barge has been awarded to the Los Angeles Shipbuilding and Drydock Company, San Pedro, Calif., by the Julian Petroleum Corporation. The new barge will be used by the Julian Petroleum Corporation in the bunkering trade. The price involved was not made public.

Sun Shipbuilding Co. Building Tanker for Stock

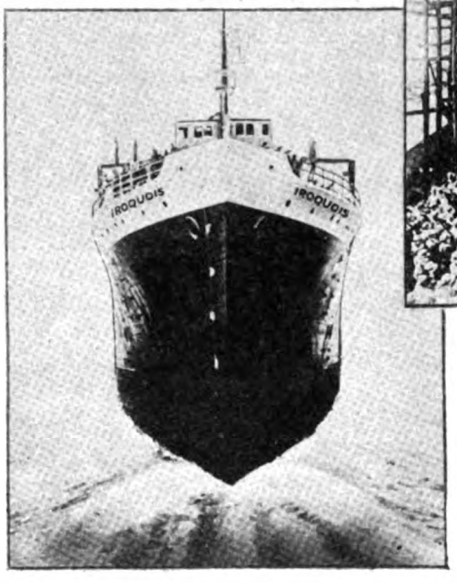
INFORMATION has been received that the Sun Shipbuilding and Drydock Company, Chester, Pa., is building an oil tanker for stock. Although no specific details are available of the characteristics of this vessel, it is believed that she will be of about 12,000 tons deadweight carrying capacity. Power will be supplied by reciprocating engines.

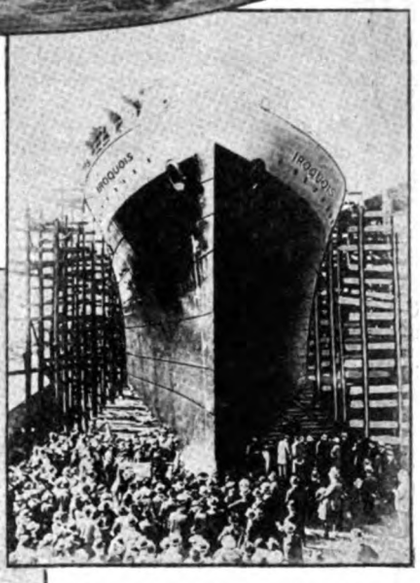
Dredge Tender

Sealed proposals will be received by the United States Engineer Office, Norfolk, Virginia, until 12 m. January 20, 1927, and then opened, for constructing one 35-foot by 9-foot by 4-foot 1-inch motor dredge tender. Further information may be obtained on application.



S.S. Iroquois as she will look when completed





(Above) The Iroquois ready for launching at Newport News
(Left) The ship leaving the ways

TRADE PUBLICATIONS

GASOLINE HOISTS.—The Lidgerwood Manufacturing Company, New York, in a bulletin recently issued presents specifications and illustrations of Lidgerwood gasoline hoists which have been developed to meet the demands for a self-contained unit of this character.

CALENDAR.—The France Packing Company, Tacony, Philadelphia, Pa., has issued a calendar for the year 1927. At the head of each sheet of this calendar drawings are shown of various types of France packing; a list of branch offices of the company is also given on the last sheet of the calendar.

UNIT COAL PULVERIZERS.—The Aero Pulverizer Company, a subsidiary of the Power Specialty Company, New York, has issued bulletin No. 36, outlining the development of the multi-chamber type of coal pulverizer. Applications in stationary boiler practice of this pulverizer are illustrated and described.

WASTE HEAT STEAM GENERATOR.—The La Mont waste heat steam generator for carburetted water gas, blue gas, producer gas, oil gas and the La Mont duplex steam-sealed valve, utilizing the combination of inlet and outlet valves are described in a catalogue recently issued by the La Mont Corporation, New York.

FOSTER WATER BACKS.—The December, 1926, bulletin, issued by the Power Specialty Company, is devoted to details of the Foster water back. Typical examples of the use of this water-cooled wall in various types of boilers with illustrations and drawings of the water back installation are features of this bulletin.

BURMEISTER AND WAIN.—The firm of Burmeister and Wain, Ltd., Copenhagen, Denmark, has issued a folder containing descriptions of four motor cargo liners powered by Burmeister and Wain Diesel engines. These include the motorship *Danmark* owned by the East Asiatic Company, Ltd., the Blue Funnel cargo liner *Peisander,* the motorship *Touraine* for the Wilhelmsen Lines and the Blue Funnel liner *Orestes* for the Australian trade

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which is the fastest motor cargo ship so far built, having a service speed of 15 knots.

CALENDAR.—The 1927 calendar issued by the Morse Dry Dock & Repair Company, Brooklyn, N. Y., is illustrated with several views of large ships in dry dock at the plant for repair. The locations of the main plant, the upper yard and the New York offices of the company are listed.

NITRALLOY.—The Ludlum Steel Company, Watervliet, N. Y., makes Nitralloy the subject of a descriptive catalogue recently issued. This material is a special steel capable of being case hardened at low temperature without deformation. Complete tabular data are given of the method of tempering various grades of this steel and the physical characteristics which result from its treatment.

DRY DOCK PLANT.—The Simpson Dry Dock Plant at Boston, with its equipment and facilities for ship repair is the subject of a bulletin issued by the Bethlehem Shipbuilding Corporation, Ltd., with general offices at Bethlehem, Pa., and general sales offices at 25 Broadway, New York. The bulletin is well illustrated with views of the plant as well as typical repair jobs that have been carried out there.

CALENDAR.—The Columbian Rope Company, Auburn, N. Y., pursuing the policy of the last few years, has issued a 1927 calendar featuring a copy of an original canvas by Charles N. Patterson, the famous marine artist, of the clipper ship "The Glory of the Seas." The scene shows this old-time clipper ship caught in the teeth of a rising gale and shows all the action that such a scene would inspire.

CALENDAR.—The 1927 calendar issued this year by John A. Roebling's Sons Company, Trenton, N. J., features a reproduction from an original oil painting by H. R. McGinnis entitled "Removing the Slides from Culebra." The oil painting shows one of the dredges in operation at the Culebra cut. This dredge was equipped with a Roebling blue center steel wire rope 3¼ inches in diameter composed of six strands of 37 wires each with an independent wire rope center consisting of six strands of 19 wires each. This was the largest hoisting rope ever used in dredge work.

NICKEL STEEL.—In a folder sent out by the International Nickel Company, New York, covering data and applications pertaining to nickel steel, are several bulletins which are of interest to the marine field. Bulletin No. 2 discusses the physical and mechanical properties of nickel steel; bulletin No. 3 the heat treatment and applications of nickel and nickel chromium steels; bulletin No. 4 the use of nickel chromium and other alloying elements in making steel castings; bulletin No. 5 the mill inspection of steel; bulletin No. 9 the physical properties of nickel and nickel chromium steel.

ENGINEERING ACHIEVEMENTS.—The annual bulletin of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., for the year 1926 has been issued under the title "The Engineering Achievements of the Westinghouse Electric and Manufacturing Company." The material in this outline of developments through the year has been compiled by H. W. Cope, assistant director of engineering. It is a condensed account of some of the achievements of this company out of the many hundreds which have been made during the year. The work covers every conceivable application of electricity from turbine generators through the range of equipment for the transportation industries, radio, power transmission and other lines. In the marine field, the Diesel-electric yacht *Aloha* is featured as well as turbo electric ferry boats, Diesel electric fire boats, Diesel electric tug boats, marine auxiliaries and electrical auxiliaries of many types.

BUSINESS NOTES

Harry Carlton and Associates have moved their offices from 30 Church street, New York, to 52 Vanderbilt avenue.

The Parsons Marine Steam Turbine Company, Ltd., announces the removal of its offices to 75 West street, rooms 1504 and 1505, Evening Post Building, New York.

The name of the Pacific-Caribbean-Gulf Line has been changed to Gulf-Pacific Line. Swayne and Hoyt will continue to act as agents for the line at San Francisco.

The name of the Admiral Oriental Line has been changed to American Mail Line and the company's transpacific ships, its headquarters in Seattle and its chain of offices and agencies, which encircle the world, will all be operated under the name of American Mail Line. The change will do away with the confusion which has existed in the past between the Admiral Line, which operates coastwise steamers on the Pacific seaboard and the Admiral Oriental Line which is a transpacific service entirely.

Alexander McNab opened an office at Room 702, 1 Broadway, New York, on January 1 to conduct the business of the McNab Company including the well known lines of engine direction indicators, logometers, Vista system of stern tube lubrication, torsion meters, Dial-O-Meters (super tank gage), revolution counters, etc.

The American Brown Boveri Electric Corporation, Camden, N. J., has announced that Harold D. Gregory has joined the patent department of the company. J. M. Van Nieukerken has joined the staff of the company as a railroad project engineer. Wilfred S. Lowry, who recently joined the organization as an application engineer, has been assigned to the blower division.

At a recent meeting of the board of directors of Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn., plans were completed for the total absorption of the Johns-Pratt Company by the Colt concern. The Johns-Pratt Company, for years one of the foremost manufacturers of sheet packing, has more recently come prominently before the electrical industry of the country as the pioneer developer of electrical protective devices including meter service switches, fuses, service boxes and high voltage underground equipment. For several years past the control of the Johns-Pratt Company has been held by the Colt's Patent Fire Arms Manufacturing Company but from this time on the former concern will cease to function independently.

Marine Societies

America

American Marine Association. 30 Church St., New York. President—Col. E. A. Simmons.

American Marine Standards Committee. Chairman, Colonel E. A. Simmons. Secretary, A. V. Bouillon, Division of Simplified Practice, Department of Commerce, Washington, D. C.

American Society of Marine Designers. Secretary—B. G. Barnes, 202 Kendrick Ave., Quincy, Mass.

American Society of Marine Engineers. 605 Market St., San Francisco, Calif. President—Benjamin S. Free. Secretary—Wm. H. Thille.

American Society of Naval Engineers. Navy Department, Washington, D. C. Secretary-Treasurer—Commander H. B. Hird, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

American Steamship Owners' Association. 11 Broadway, New York. President—Alfred Gilbert Smith.

Atlantic Coast Shipbuilders' Association. 1600 Walnut Street, Philadelphia, Pa. Secretary—C. S. King.

Council of American Shipbuilders, Inc. 30 Church St., New York. President—Homer L. Ferguson. Secretary-Treasurer—Henry C. Hunter.

Jersey Marine Club, 4th and River streets, Hoboken, N. J. President—Col. Bartlett.

Lake Carriers' Association. President—J. S. Ashley. Secretary—George A. Marr, Rockefeller Building, Cleveland, O.

National Association of Engine and Boat Manufacturers. 29 West 39th Street, New York City. Secretary—Ira Hand.

National Association of Masters, Mates and Pilots. National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

National Marine Engineers' Beneficial Association. Headquarters, 311-315 Machinists Building. Washington, D. C. President—Wm. F. Yates. Secretary—Albert L. Jones.

National Merchant Marine Association. Munsey Bldg., Washington, D. C. President—Hon. J. E. Ransdell.

Neptune Association. 21 Pearl St., New York City. Secretary-Treasurer—Captain John F. Milliken.

New York and New Jersey Dry Dock Association, 111 Broadway, New York. President—Jonathan Moore.

Ocean Association of Marine Engineers. 15 Whitehall St., New York. Secretary—Bert L. Todd.

Port of New York Authority. 75 West Street, New York. Chairman—George S. Silzer. Secretary—Wilson J. Vance.

Society of Naval Architects and Marine Engineers. 29 West 39th Street, New York. Secretary and Treasurer—Daniel H. Cox.

The Maritime Association of the Port of New York. 78 Broad St., New York City. President—John Dowd. Secretary—John F. Manning.

The New York Tow Boat Exchange. 11 Moore St., New York. Manager—Charles A. Mason.

The Propeller Club of the Port of New York. President—Edward A. Colson, 85 Liberty Street, New York. Secretary—William C. Gray, 17 Battery Place, New York.

United States Naval Institute. Naval Academy, Annapolis, Md. Secretary and Treasurer—Captain H. A. Baldridge, U. S. N.

United States Ship Operators' Association. 149 Broadway, New York. President—Winchester Noyes.

Canada

Grand Council N. A. of M. E. of Canada. Grand Secretary-Treasurer—W. A. MacDonald, 62 Albert St., Halifax, N. S.

Great Britain

Institute of Marine Engineers, Incorporated. 85/88 The Minories, London, E.1.

Institution of Engineers and Shipbuilders in Scotland. 39 Elmbank Crescent, Glasgow.

Institution of Naval Architects. Adelphi Terrace, London, W. C.

Northeast Coast Institution of Engineers and Shipbuilders. Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Italy

Collegio Degli Ingegneri Naval e Meccanici in Italia.

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